소프트웨어 직군을 위한 직무영어

목차

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Lesson 01

Introduction to ICT

Reading

Read this section before class. Be prepared with any questions.

What did you want to be when you were a child? Did you want to be a doctor? A police officer? These jobs are very important for our society. But did you ever imagine yourself as a software engineer? How about a computer scientist?

These are some examples of careers in the field of Information & Communications Technology (ICT), which is the **cornerstone** of business and education in the twenty-first century.

ICT professionals have a number of responsibilities. For example, software developers create and test software, while designers **ensure** that using the product is easy and efficient. Everyone in the Information & Communications Technology industry works together to keep products and processes running smoothly.

Dialogue: Explain a skill

Starting with the student, take turns reading this dialogue out loud.

Hannah: Good morning, and thank you for coming to this interview for a job as a software engineer.

Harry: Thanks for inviting me. I'm happy for the opportunity to tell you about the experiences that have prepared me for this position.

Hannah: Great, let's get started. Can you tell me about a time when you had to **look into** a problem in your software program?

Harry: Sure. Whenever I found a problem in the software, I had start by **evaluating** the situation. Once I understood the problem, then I could think of some appropriate solutions and test them.

Hannah: This skill is definitely important for software engineers. I'm glad you understand the problem-solving process.

Lesson 01

Introduction to ICT

Words & Expressions

Review these key terms as they are used in the context of this unit. Discuss any terms that need further explanation.

cornerstone	초석	a very important feature upon which other things depend
ensure	보장하다	to make sure, certain, or safe
to look into	조사하다	to investigate something or get more information about it
evaluate	평가하다	to assess the qualities of something by studying it
pros and cons	장단점	advantages and disadvantages to consider before deciding, from Latin “pro et contra” (for and against)

Discussion questions

If you have time, discuss the answers to these questions.

1. What did you want to be when you were young? What is your job now?
2. What are some ways that Information & Communication Technology has had an impact on business and education in our society?
3. Discuss the **pros and cons** of technology in your own life.

Lesson 02

Computer Hardware

Reading

Read this section before class. Be prepared with any questions.

In the field of Information & Communication Technology, nothing is possible without hardware. Computer hardware includes all the physical parts of the computer system, from simple personal computers (PCs) to expensive supercomputers.

Every personal computer system has the same basic parts. Some of these are contained inside the computer case, while others are attached externally.

The motherboard, CPU, RAM, power supply, and **persistent** data storage device are all **housed** in the computer case. The motherboard is a **complex** circuit board that connects the other parts to each other, while the CPU (central processing unit) performs calculations and the RAM (random-access memory) **temporarily** stores data. Data storage devices include both hard disk drives and solid-state drives (SSD).

Computer hardware also includes **peripheral** devices. For example, laptops use a touchpad and keyboard to input information and a screen and speakers to output information.

All together, these physical **components make up** a computer system.

Dialogue: Describe a solution

Starting with the student, take turns reading this dialogue out loud.

Hannah: Thanks again for attending this job interview with me today. I'd like to ask you some more questions about your experience with computer hardware.

Jay: Sure, I'm happy to tell you what I know.

Hannah: Excellent. What would you do if your colleague came to you and said, "My computer won't start"?

Jay: At my previous company, people would often ask me to fix their computer problems. For example, if someone's computer wouldn't start, I would ask them if they saw any lights. If not, I would ask them if all of the cables were plugged in securely.

Hannah: I can **imagine** that many computer problems were caused by unplugged cables!

Jay: That's right. But if we were still having trouble after checking the cables, I would offer to contact the support desk on their behalf.

Lesson 02

Computer Hardware

Words & Expressions

Review these key terms as they are used in the context of this unit. Discuss any terms that need further explanation.

persistent	영속적인	continuing to exist after a long period of time
to house	수용하다	to provide a space for something
complex	복잡한	hard to separate, analyze, or solve
temporarily	일시적으로	during a limited time
peripheral	주변기기	a device connected to a computer to provide communication or auxiliary functions
component	부품	a part of a larger thing
make up	구성하다	to combine to produce, constitute
to imagine	생각하다	to suppose or assume

Discussion questions

If you have time, discuss the answers to these questions.

1. What type of PC do you use at home: a laptop, a desktop, or both?
2. Do you use your PC for gaming or watching TV? What kind of peripheral devices would you need to enjoy these activities?
3. What are the differences between your personal computer and your work computer, in terms of hardware?
4. What do you think of this statement? “Hardware is nothing without software.”

Lesson 03

The Internet

Reading

Read this section before class. Be prepared with any questions.

Although the Internet did not exist just 50 years ago, it has already changed the way we interact with the world. Today, almost all telecommunications **rely on** the Internet, and more than half of the world population has access to the Internet .

But just what is “the Internet”?

The Internet is the **conceptual** term for a network that connects computers all over the world. Invented in the U.S. in the 1960s and commercialized in the early 1990s, the Internet provides access to information. Today, almost all communication relies on the Internet, from email to news.

Most people who use the Internet **take it for granted**. When you load a page in your web browser, you are accessing a vast physical infrastructure of servers, fiber-optic cables, and even satellites.

Dialogue: Ask for more information

Starting with the student, take turns reading this dialogue out loud.

Hannah: I’m hoping you can tell me more about your experience with online tools. Which ones have you used?

Jay: Oh, yeah. In my last role, I used tools for hosting code, making diagrams, tracking issues, and more.

Hannah: Can you explain what you mean by hosting code?

Jay: Of course. When my team and I are working on a program, we use the online **repository** to store the code. When any one of us makes changes to the code, we all see the changes.

Hannah: Thanks for explaining. As a hiring manager, I’m not familiar with all of the technical **jargon**.

Jay: No problem.

Lesson 03

The Internet

Words & Expressions

Review these key terms as they are used in the context of this unit. Discuss any terms that need further explanation.

rely on	의지하다	to need for support, help, etc.
conceptual	개념적인	based on an abstract idea
take for granted	당연한 일로 여기다	to fail to appreciate or understand something, usually as a result of overfamiliarity
vast	방대한	very large; wide-ranging
repository	저장소	a place where things are stored
jargon	전문용어	special words or phrases used within a particular field or group that other people may not understand
everyday	매일의	used or happening every day (different from “every day,” an adverb phrase which means “daily”)

Discussion questions

If you have time, discuss the answers to these questions.

1. Do you remember what it was like before the Internet was a part of our **everyday** lives? What was it like?
2. What are the pros and cons of being constantly connected to the Internet?
3. Do people have the right to be connected to the Internet?
4. How much control should a government have over its people’s access to the Internet?

Lesson 04

Education

Reading

Read this section before class. Be prepared with any questions.

People who work in Information & Communication Technology come from a broad range of educational backgrounds—everything from business to mathematics. That's because the field of ICT depends on a **diverse** set of skills, knowledge, and experience.

Although it's impossible to define the **common denominator** of ICT professionals, the majority of people have earned a Bachelor of Science (B.S.) degree in computer engineering or computer science. They start by learning calculus, linear algebra, statistics, and programming. These subjects provide a foundation for studies in computing, especially computer engineering.

Other degree programs that prepare people to work in ICT include a Master of Business Administration (MBA) or Bachelor of Arts (B.A.) in design or philosophy. Other relevant B.S. programs include economics and neuroscience.

Dialogue: Describe experiences

Starting with the student, take turns reading this dialogue out loud.

Hannah: Why don't you tell me about your educational **qualifications**? How did you **get started** as a software engineer?

Jay: Sure! I **majored** in computer science and mathematics. I particularly enjoyed my algorithms courses.

Hannah: Sounds challenging. Did you complete any internships while you were a student?

Jay: Yeah, I completed several internships. In one summer internship, I worked for a cybersecurity company. I was responsible for developing tools using Python and Unix shell scripting.

Hannah: And did you work on any special projects as part of your degree program?

Jay: Yes, during my senior year, I was able to complete an honors thesis in computer science. I'm fortunate to have had an advisor with **expertise** in computer networking.

Lesson 04

Education

Words & Expressions

Review these key terms as they are used in the context of this unit. Discuss any terms that need further explanation.

diverse	다양한	very different; having a lot of variety
common denominator	공통분모	something shared by all members of a group
qualification	자격	an accomplishment that makes someone suitable for profession
to get started	시작하다	to begin something that will take a long time to complete
to major	전공하다	to specialize in a specific university subject
expertise	전문지식	comprehensive skill and/or knowledge in a particular field
humanities	인문학	areas of study that relate to culture, literature, history, art, music, and philosophy

Discussion questions

If you have time, discuss the answers to these questions.

1. Describe your own education. What were your majors? How many years did you study?
2. What was the hardest course you took while studying for your degree?
3. Should ICT students be required to study **humanities** and other liberal arts courses?

Lesson 05

Career Paths in ICT

Reading

Read this section before class. Be prepared with any questions.

ICT provides many opportunities to explore, change roles, and build new skillsets. For this reason, a career in Information & Communication Technology can look very different from person to person. For example, in the first 15 years of their career, one person could be a systems administrator, test lead, business analyst, project manager, and product owner. Another could spend all 15 years as a software testing **contractor**. Neither **path** is more "normal" than the other!

Adding skills and strengthening networks is part of **professional development**. One way to participate in professional development is to join an international group like the IEEE Computer Society or the Association for Computing Machinery (ACM). Members of these groups can speak at presentations, contribute to publications, and earn certifications. Some countries also have their own professional organizations for ICT professionals.

Other professional development activities include volunteering, attending informal meet-ups, and finding mentors.

Dialogue: Make a prediction

Starting with the student, take turns reading this dialogue out loud.

Hannah: We're almost done with this interview. I just want to ask one more question: Where do you see yourself in 5 years?

Jay: That's a good question, Hannah. I have spent a lot of time thinking about my plans for the future. I like working as a software engineer, but I'm also interested in academic research.

Hannah: Do you see yourself doing a PhD anytime soon?

Jay: That could be **in the cards** for me, certainly. If I did start a PhD, I would want to study part-time while continuing to work. I want to stay **in touch** with the industry.

Hannah: If you were to **pursue** a PhD, what do you think you might specialize in?

Jay: Based on my previous experiences, I'm interested in studying cybersecurity.

Hannah: Great! Jay, that's all for today. Thanks for your time, and I hope to get back to you soon about the next steps for the job.

Lesson 05

Career Paths in ICT

Words & Expressions

Review these key terms as they are used in the context of this unit. Discuss any terms that need further explanation.

contractor	도급업자	a person who provides services to a company but is not employed by them
path	길	the direction someone or something takes
professional development	전문성 개발	formal and informal opportunities for advancing one's career (such as earning certificates or networking)
in the cards	가능성 있는	very likely to happen
in touch	계속 접하다	in communication/contact
pursue	추구하다	to follow in order to overtake, capture, or defeat
twist and turn	자주 변하다	to curve or change direction often

Discussion questions

If you have time, discuss the answers to these questions.

1. Has your career taken "**twists and turns**" or has it stayed on the same path?
2. What are your future career goals?
3. Are you working on any special projects?
4. Do you participate in any professional development activities?

Lesson 06

System Software

Reading

Read this section before class. Be prepared with any questions.

Out of the box, every computer comes with system software, including firmware and an operating system.

When you first power on a computer, the first program that runs is BIOS, or Basic Input/Output System. BIOS is an example of firmware, a type of permanent, read-only program that controls the computer hardware. Built into a microprocessor on the motherboard, BIOS starts the computer's operating system.

The operating system is the primary **interface** between computer hardware and software applications. Users can install one or more operating systems on their hard drives. Worldwide in 2018, 82 percent of desktops used Microsoft Windows, while 13 percent used Apple macOS. The rest ran on **variations** of Linux, which is a free, open-source operating system.

Another type of important system software is a device driver. The driver is a simple program that tells the computer how to use a hardware device like a printer, USB flash drive, or monitor. Device drivers are firmware but can be updated.

Dialogue: Make a comparison

Starting with the student, take turns reading this dialogue out loud.

Maya: Good morning! I'm Maya, the technical support specialist here. You must be our newest software developer.

Jay: Yep, that's me. I'm happy to be here.

Maya: Welcome to the company. Let's get you started on your computer.

Jay: Sounds good.

Maya: Okay, as you can see, you have a Windows computer with the latest operating system.

Jay: Good to know. I'm just **curious**, since I'm used to programming in the macOS environment… Would it be possible to get an Apple computer?

Maya: Hmm. You'll have to discuss it with your manager, but I think it's possible. Anyway, I'm here if you ever **run into** problems with your hardware.

Lesson 06

System Software

Words & Expressions

Review these key terms as they are used in the context of this unit. Discuss any terms that need further explanation.

interface	접점	a point of communication between two entities
variation	변형	a different or distinct version of something
curious	궁금한, 기이한	exciting attention as strange, novel, or unexpected; odd
run into	우연히 만나다	to encounter something or someone you didn't expect to see
market share	시장 점유율	in a specific geographic region, the amount of commercial activity controlled by a particular company or product

Discussion questions

If you have time, discuss the answers to these questions.

1. What operating system do you use on your PC?
2. In this unit, you read about the global **market share** of operating systems. In Korea, Windows has 90 percent of the market and macOS has 6 percent.

   A. How does the market share in Korea compare to the global market share?

   B. Why do you think macOS is less popular in Korea than it is worldwide?

Lesson 07

Application Software

Reading

Read this section before class. Be prepared with any questions.

"There's an app for that."

Remember this advertising slogan? The concept of an "app" **predates** smartphones, but the first App Store launched for the iPhone in 2008. In the app store model, users can buy, download and install apps in one click. Its popularity has led to the availability of other app stores on all devices and operating systems.

So as with smartphones, personal computers also have "an app for that." Application software is included with almost all computers, whether it is pre-installed or provided as a license.

The most common types of computer application software are web browsers, image editors, multimedia players, email clients, and office **suites**. An office suite is a bundle of productivity software that includes a word processor, spreadsheet, and presentation program. Businesses can also buy a bundle of **enterprise** software, such as database management and desktop publishing.

You can install third-party software through your computer's app store or from the Internet. Unless it's freeware, you have to pay for either a **subscription** or a one-time license.

Dialogue: Describe necessity

Starting with the student, take turns reading this dialogue out loud.

Maya: Hi again, Jay. I've just spoken to my manager. He wanted to know which software programs you need for your work.

Jay: Oh, great. I need more than a couple, so… Can I send you an email with a list?

Maya: Sure. I just have to check everything with my manager, especially if there are licensing fees.

Jay: I think most are free, but I can let you know when I make the list of what I need.

Maya: That would be really helpful. And is anything part of a suite?

Jay: Well… In the past, I've used some tools from Adobe, but I don't want to **rack up** any unnecessary charges.

Maya: No, it's all right, we already have a subscription to Adobe Creative Cloud. We can just make a log-in for you.

Lesson 07

Application Software

Words & Expressions

Review these key terms as they are used in the context of this unit. Discuss any terms that need further explanation.

predate	~보다 앞서 오다	to exist at a date earlier than something
suite	묶음	a set of programs sold and installed together
enterprise	기업	a business or company (especially a start-up)
subscription	가입	the acceptance attested by the signing of one's name
rack up	얻다	achieve, gain
justify	정당함을 증명하다	show or prove to be reasonable

Discussion questions

If you have time, discuss the answers to these questions.

1. What's the most useful application on your PC? Did it come with your computer, or is it a third-party application?
2. What's the most you've ever paid for application software? What was the program? Was the value **justified** by the cost?

Lesson 08

Cybersecurity

Reading

Read this section before class. Be prepared with any questions.

Security is an essential part of any system that **relies on** hardware, software, and data. This includes everything from PCs to large organizations like banks, utility companies, corporations, airlines, government branches, hospitals and more. Keeping these systems safe from theft, damage, or **disruptions** is called "cybersecurity." Today, many people in ICT have jobs related to cybersecurity, including analysts, engineers, architects, administrators, and even Chief Officers.

Some potential threats include computer viruses, spyware, and **ransomware**. These are all types of **malicious** programs that try to steal information or money. Together, these threats are called "malware."

To avoid malware on your PC, make sure you have taken **adequate** security measures. First, install recommended updates from your operating system to get the latest security patches. Second, install antivirus software. Third, avoid illegal downloads, since these are often packaged with malware. If you think your computer has been infected, use the antivirus software to **quarantine** any suspicious files.

Dialogue: Emphasize a point

Starting with the student, take turns reading this dialogue out loud.

Maya: The company computers have several security **protocols** in place. For example, you won't be able to download any programs without administrative access.

Jay: That makes sense. Do you have the admin password?

Maya: Yes, you'll have to let me know if you need to install anything.

Jay: Is there anything else I need to do to make sure I'm doing my part?

Maya: You should know about our Bring Your Own Device policy. You can connect your personal laptop and phone to the Internet here, but you can't access or store company data using your device.

Jay: All right, noted. I wouldn't want to be the cause of any data **breaches**.

Maya: **That said**, you're welcome to take your company-**issued** laptop home with you.

Lesson 08

Cybersecurity

Words & Expressions

Review these key terms as they are used in the context of this unit. Discuss any terms that need further explanation.

rely on	의지하다	to need someone or something for support, help, etc.
disruption	두절	a break or interruption in the normal course or continuation of some activity
ransom	몸값	a consideration paid or demanded for the release of someone or something from captivity
malicious	악의적인	intending to harm (from the Latin prefix mal- meaning “bad” or “evil”)
adequate	적정한	acceptable (in terms of quality or amount)
quarantine	격리	to isolate something unknown in case of potential threat
protocol	통신규약	a set of rules that control how devices can exchange data
breach	위반, 파괴	a vulnerability leading to an attack and/or loss of secure information
issued	지급하다	supplied or distributed from a specific source
that said	그렇긴 하지만	even so (used to introduce an exception to a previous statement)

Discussion questions

If you have time, discuss the answers to these questions.

1. Have you ever been the victim of a cybersecurity attack? Describe the situation and what you did to fix it.
2. What’s the best way to avoid malware on your PC?
3. In the dialogue, Maya and Jay discussed a Bring Your Own Device (BYOD) policy. What is your company’s BYOD policy?

Lesson 09

Cloud Computing

Reading

Read this section before class. Be prepared with any questions.

“Racking and stacking” is an informal term that refers to building the hardware in a data center. Before cloud computing, a company would need to build its own data center if it needed resources for storing and sharing data. This required a large **upfront** investment.

Now, businesses can look to cloud computing as an **affordable** solution. With cloud computing, companies can access services using the Internet. These services include servers, databases, networks, and software. They pay only for the computing resources they need, allowing them to scale up or down as needed.

And pay they do—in 2018, public clouds were worth more than US$180 billion.

Cloud providers include Amazon, Microsoft, and Google. These providers operate massive data centers and employ specialized engineers. So they can **offer** computing power, storage, and bandwidth at a **relatively** low rate. This service is called Infrastructure-as-a-Service (Iaas).

Dialogue: Express confusion

Starting with the student, take turns reading this dialogue out loud.

Jay: Hey Sarah, quick question. I see that our Software-as-a-Service is available on two platforms, server and cloud.

Sarah: Yeah, that’s right. We launched the cloud version of the service just a couple of years ago.

Jay: But I thought the cloud version also used a server.

Sarah: Oh, I see how that can be confusing. Our “server” version is hosted by the customer, either on their own server or a third-party server like Amazon Web Services.

Jay: And the “cloud” version runs on our server?

Sarah: Yep, so the customer doesn’t need to set up their own servers to use our SaaS. They just pay every month for the number of **licensed** users.

Jay: I get it now. Thanks for explaining.

Lesson
09

Cloud Computing

Words & Expressions

Review these key terms as they are used in the context of this unit. Discuss any terms that need further explanation.

upfront	선불의	a payment made in advance of receiving a service
affordable	적정 가격의	sold or provided at a reasonable cost
offer	제안하다	to make available for sale
relatively	상대적으로	to a certain degree, especially when compared with other things of the same kind
licensed	허가된	having permission to do or use something

Discussion questions

If you have time, discuss the answers to these questions.

1. What are some disadvantages of cloud computing for a business?
2. Who owns data that is stored in the cloud?
3. You read that IaaS providers have a cost advantage by operating on a large scale. The formal term for this is "economies of scale." Can you think of other example of economies of scale?

Lesson 10 Database

Reading

Read this section before class. Be prepared with any questions.

Information is everywhere, and information is data. To store, organize, and search for data, we use databases. Almost everyone who's used a spreadsheet has used a database.

Many databases are built using SQL, a computer language for **querying** data. SQL databases are relational databases, which have rows and columns. These databases sit on servers like Oracle Database and MySQL and are maintained by database administrators.

A newer type of database is called a non-relational database. While relational databases store information in a matrix, non-relational databases are less structured. For example, a database of documents could be organized by metadata, like author name or date.

Dialogue: Make a suggestion

Starting with the student, take turns reading this dialogue out loud.

Jay: Sarah, can I suggest something? I see that one of our larger databases is slow. Is there anything **in the works** for a new one, maybe a NoSQL database?

Sarah: Oh, boy! You're definitely not the first to notice the problems with our current database.

Jay: Hmm. It looks simple, but it's not. I'm finding it difficult to use.

Sarah: I know you're right. Our database architect is in the process of planning and implementing a new database.

Jay: I can imagine that it's a challenge to find a solution that can grow with the business, but a very **worthwhile** one.

Sarah: Yes, and I think he has a **lead** on something that'll also stay under **budget**.

Lesson 10

Database

Words & Expressions

Review these key terms as they are used in the context of this unit. Discuss any terms that need further explanation.

query	문의하다	to ask a question about something, especially to check its validity or accuracy
in the works	논의되고 있는	being planned or worked on
worthwhile	가치 있는	worth the time, money, or effort spent
lead	선두, 선례	a promising opportunity or a person who could be useful

Discussion questions

If you have time, discuss the answers to these questions.

1. What is the difference between data and metadata?
2. Have you used database management software? If so, describe your experience with this type of software.
3. What’s a type of database that people use every day?
4. Discuss non-relational databases. What are the advantages and disadvantages of this type of database?

Lesson 11

Software Development Life Cycle

Reading

Read this section before class. Be prepared with any questions.

The software development life cycle, or the SDLC, is the process of building software. Throughout every phase of the life cycle, the team documents their work. The phases of the life cycle are defined below:

1. ANALYZE & PLAN. The business determines whether the software is **feasible**. Then, they make a list of the desired features and functions for the software, called “requirements.”
2. DESIGN. The team starts planning the architecture of the software, plus **wireframes** and prototypes to represent how the software might look and feel.
3. CODE. Developers write code for the software using programming languages. This phase results in functional software.
4. TEST. The team looks for bugs, security **vulnerabilities**, and other issues in the code and/or software.
5. RELEASE. Once the testing team approves the software, the software is released to the market. This phase is also called **deployment**.
6. MAINTAIN. After the software is released, the team provides support and **troubleshooting**. They continue to update the software with improvements and any new features.

Remember that the software development life cycle is flexible. Not every team will move through every phase of development. The actual phases and amount of work accomplished in each cycle is determined by the development model the team chooses.

Dialogue: Describe goals

Starting with the student, take turns reading this dialogue out loud.

Todd: Heather, thanks for meeting me. Our company wants to become more **agile**. So we’re looking for someone with agile experience who can guide our software development teams.

Heather: Todd, I’m happy to help you find the right candidate. But first, can you tell me a bit about your current software development process?

Todd: Yes, we currently use a waterfall model. We spend a lot of time writing business cases, and planning the product and its features.

Heather: So you want to find someone who knows how to get the product to market in less time?

Todd: Yes, that’d be great. We’ve found that by the time we build a feature and release it, most of our customers are already bored with that feature.

Heather: Agile methods will help you regain your **competitive edge** in the market. Todd, I have a few candidates in mind already. I’ll get back to you soon with their résumés.

Todd: Great, thank you so much, Heather.

Lesson 11

Software Development Life Cycle

Words & Expressions

Review these key terms as they are used in the context of this unit. Discuss any terms that need further explanation.

feasible	실현 가능한	practical or at least possible
wireframe	뼈대, 구조	the concept, structure, and organization of something
vulnerability	취약성	an area that could be attacked or exploited
troubleshooting	장애진단	identifying and correcting problems in a system
deployment	전개, 배치	putting something into action
agile	민첩한, 기민한	ready to move quickly and easily
competitive edge	경쟁 우위	an advantage based on success in competition

Discussion questions

If you have time, discuss the answers to these questions.

1. Define “software development” in your own words. Do you think that software development is cyclical, as described in the SDLC?
2. Do these SDLC phases and definitions make sense to you? What would you change, based on your knowledge and experience?
3. The phases are analyze, design, code, test, release, and maintain. Of these, what’s the most important phase and why?

Lesson 12

Development Models

Reading

Read this section before class. Be prepared with any questions.

Software development teams follow a model that guides their approach to work. From how they communicate with their colleagues to how they set goals, the chosen model influences every level of development.

In the twentieth century, the most popular software development model was the waterfall model. In this model, the team would complete each phase **in sequence** before moving on to the next phase. The waterfall model **emphasizes** the analysis and planning phase.

At the beginning of the twenty-first century, software development experienced a **paradigm** shift as people started using agile models. Two popular agile models are Scrum and Kanban. These models focus on adaptation instead of **inflexible** planning. Agile teams also prioritize **transparency** and face-to-face communication.

Depending on their resources and needs, companies can choose a model from among waterfall, Scrum, Kanban and more. Agile models are more suitable for smaller organizations and start-ups, while waterfall is used by many government and medical institutions.

Dialogue: Agile practice

Starting with the student, take turns reading this dialogue out loud.

Todd: Hey, team, please welcome Wyatt! As you know, he is here to teach us about agile practices.

Wyatt: Hi everyone! It’s great to meet you. Agile is all about communication and teamwork, and I want us to **jump right in** with a daily stand-up.

Todd: Wyatt, I think you’ll have to explain to the team what “stand-up” means.

Wyatt: Sure, can do! Every day at the same time, you will get together to share what you did yesterday, what you’re working on today, and anything that’s **blocking** your progress.

Todd: So, that’s all it is?

Wyatt: Yep, but I think you’ll see the benefits right away. For example, this daily exercise can help the team stay on track with work.

Todd: Hmm…

Wyatt: Don’t worry, I’ll be at every stand-up to help you.

Lesson 12

Development Models

Words & Expressions

Review these key terms as they are used in the context of this unit. Discuss any terms that need further explanation.

in sequence	차례로	in a continuous or connected series
paradigm	인식체계	the template, pattern, or model for a concept
emphasize	강조하다	to indicate that is particularly important or true
inflexible	융통성 없는	rigid, not able to change or respond
jump right in	즉시 하다	to get involved in something without hesitation
block	차단하다	to stop action or get in the way
transparency	투명성	being open to observation by many people

Discussion questions

If you have time, discuss the answers to these questions.

1. Do you think it's important to use a model of software development?
2. In your opinion, which model of software development is the best? Does it depend on the type of software, customer, or company?
3. Have you worked on projects that used the waterfall model? What about agile models? Which models does your company use?
4. Agile principles can apply to many different types of projects, not just software development. Discuss some ways that a Marketing or HR department might use agile principles.

Lesson 13

Software Analytics

Reading

Read this section before class. Be prepared with any questions.

To understand software analytics, let’s start by defining some terms. The word “analytics” is related to “analysis,” which **literally** means to break up something into its parts. For example, a student of **literature** might **analyze** a poem by looking at the author’s choice of words.

Meanwhile, “analytics” is a formal type of analysis that includes math and statistics. Scientists and engineers use analytics to answer questions about past events and make predictions about the future. Recent advances in big data and machine learning have also made it possible to recommend what to do based on different scenarios. Analytics can find patterns and connections using data, which is more reliable than “common sense” or **intuition**.

Analytics can be useful at any point in the software development life cycle. For example, a company might run analytics in the planning stage if they want to know which types of customers they haven’t yet reached. Later, in the release stage, they can use analytics to determine the best price for their new product.

Dialogue: Investigate a problem

Starting with the student, take turns reading this dialogue out loud.

Lauren: Hi Wyatt, thanks for meeting me. I took a quick look at the most recent data from the sign-up page.

Wyatt: Sure, we did an update to that page in the last release cycle. What did you notice?

Lauren: It’s getting close to 15,000 views per month, but I’m seeing a **drop-off** in subscriptions. Can you look into this?

Wyatt: I can, and I also noticed this trend. I’ll look into the rest of the numbers and get back to you.

Lauren: We’re relying on your data science skills! Thanks, Wyatt.

Lesson 13

Software Analytics

Words & Expressions

Review these key terms as they are used in the context of this unit. Discuss any terms that need further explanation.

literally	문자적으로	as in, the exact translation from original text
literature	문학	written artistic works, especially those with a high and lasting artistic value
analyze	분석하다	to study or determine the nature and relationship of the parts of
intuition	직관	the ability to understand something without logic or conscious thought
drop-off	감소	a decline or decrease (like a cliff)
discrimination	차별	different treatment of people based on category, especially race, age, or sex

Discussion questions

If you have time, discuss the answers to these questions.

1. Can you think of an example of analytics in your everyday life?
2. What's the advantage of using data to answer questions? What are the disadvantages, if any?
3. Do analytics present any risks to society? Do you think people could experience **discrimination** based on their online behaviour?

Lesson 14

Documentation

Reading

Read this section before class. Be prepared with any questions.

Documentation is a key component of every software product. Software documentation explains how products work and provides a single source of truth. It **ensures** that developers and **stakeholders** all understand the project and its goals.

Throughout the software development life cycle, process documentation is continuously created and updated by all team members. Some types of project documentation include business cases, design specifications, requirements and user stories, test plans, and system documentation about code.

Before the product is deployed, technical writers will create user documentation. This includes tutorials, user guides, knowledge bases, and how-to manuals. Users also look for online reference tools such as FAQs, videos, and wikis. This type of documentation is **crucial** to using the product, especially when the customers aren't **power users**. Some projects will also include more detailed documentation for system administrators.

Dialogue: Give guidance

Starting with the student, take turns reading this dialogue out loud.

Wyatt: Hi Todd, can we discuss the project documentation? I've looked in some folders, but I can't find the design and technical specs.

Todd: Oh, we don't have them. I **took a stab** at writing those a while ago, but it was taking too much time.

Wyatt: Yes, but these specs are important for making sure the work is tracking with the project goals. You need that reference point.

Todd: But I thought the agile method was about building software, not documenting and planning every last detail.

Wyatt: You're right, you don't have to plan every last detail. But you do have to make a plan, and I can show you how to be more efficient.

Todd: Okay. All I can say is that I'm glad you're here to help us out.

Lesson 14

Documentation

Words & Expressions

Review these key terms as they are used in the context of this unit. Discuss any terms that need further explanation.

ensure	보장하다	to make sure, certain, or safe
stakeholder	이해 당사자	one who is involved in or affected by a course of action
crucial	중대한	extremely important or necessary
power user	고급 사용자	a knowledgeable computer user
take a stab at	시도하다	to attempt or try

Discussion questions

If you have time, discuss the answers to these questions.

1. What is your company's documentation process?
2. How might the software documentation process differ between waterfall and agile methods?
3. When documentation is done well, who benefits the most? Why?
4. What's the difference between process documentation and user documentation?

Lesson 15

Software Requirements

Reading

Read this section before class. Be prepared with any questions.

In the previous section, you read that the first phase of any software product is analysis and planning. The outputs of this phase are the requirements, which are the software features.

The first step is to gather requirements. A product owner (PO) will research customers' needs. The PO will also meet with designers and developers to develop the list of requirements.

Then, the PO will write a Product Requirements Document (PRD) for the software. This document defines the product, including its purpose, features, **functionality**, and behavior. The product owner will then share this document with any other teams involved in making and selling the product.

Finally, the PO may write "user stories" that re-word the requirements from the user's **perspective**. A user story might be something like, "I want to be able to find words in the document so that I can save time while searching for information."

Gathering requirements is a **critical** step in building a successful product.

Dialogue: Set expectations

Starting with the student, take turns reading this dialogue out loud.

Harry: Hi Max, I wanted to get some input from you while I'm gathering requirements for our new app.

Max: Sure, what are you thinking?

Harry: As you know, customers are **at the heart of** everything we do. So how can we put this into practice?

Max: Well, who are the customers for this app?

Harry: Based on our research, we think this app could be a hit with active parents.

Max: That sounds really specific… I'll have to take another look at the research summary after this. But I think the most important thing is to make sure we know exactly what we want to **accomplish** and why.

Harry: I agree. The Product Requirements Document will guide us as we start development on the app.

Lesson 15

Software Requirements

Words & Expressions

Review these key terms as they are used in the context of this unit. Discuss any terms that need further explanation.

functionality	목적, 기능	the purpose for which something exists to fulfill
perspective	관점	a person’s point of view
critical	중요한	having importance in the success or failure of something
at the heart of	핵심의	to be the most important part of something
accomplish	완수하다	to bring to completion
obstacle	장애	a thing that prevents or hinders progress

Discussion questions

If you have time, discuss the answers to these questions.

1. What is a “requirement,” in your own words?
2. What are some **obstacles** that a product owner might face while gathering requirements and writing user stories? How can they overcome these obstacles?
3. Imagine that you are going to create a new piece of software, or a new website. What would be some user stories that you’d include in your plan?

Lesson 16

Software Architecture

Reading

Read this section before class. Be prepared with any questions.

Before anyone so much as picks up a hammer, an architect must **draw up** plans for a building. The same goes for software. That's because software and buildings are both complex systems with many risks.

So, to **reduce** risk, software architects plan the high-level structure of a product before it's built. The software architecture is the basis for future decisions and work on the product. Using a series of diagrams, it shows how information moves through the software system.

To create the architecture, software architects first analyze the product's requirements and **context** to determine the best design. Then, they create the design using a framework, which is a predefined set of logic. Throughout the process, architects receive input from stakeholders and product managers.

Dialogue: Express preference

Starting with the student, take turns reading this dialogue out loud.

Harry: Hi Sarah, I'm not clear on the difference between a framework and an architecture. Can you help me out?

Sarah: Sure. The architecture is the "**big picture**" of how we want the application to run. It's about planning the software so it's flexible and **responsive**. And the framework is…

Harry: …The framework shows how that actually works. Got it.

Sarah: Yep. Why do you ask?

Harry: I'm looking for a **solid** framework. Do you have any suggestions?

Sarah: Yes, actually. I like the framework from the Open Group. It has a large user base and a lot of reference pages online. Because of its popularity, I think it's a good investment.

Harry: Sounds good. Thanks for the suggestion.

Lesson 16

Software Architecture

Words & Expressions

Review these key terms as they are used in the context of this unit. Discuss any terms that need further explanation.

draw up	작성하다	to prepare a plan, proposal, or other document in detail
reduce	줄이다	to diminish in size, amount, extent, or number
context	맥락	the interrelated conditions in which something exists or occurs
big picture	전체적인 상황	the entire situation and everything it affects
responsive	즉각 반응하는	quick to respond or react appropriately
solid	견고한, 믿음직한	dependable, reliable

Discussion questions

If you have time, discuss the answers to these questions.

1. Is software architecture a process or an output? Is it both? What's the difference between calling it a "process" and calling it an "output"?
2. "Architecture" is an abstract concept. That makes it hard to picture in your mind. So how would you explain "software architecture" to someone who's not familiar with the term?
3. Can you explain the relationship between design and architecture? How do these two concepts relate to each other?

Lesson 17

Principles of Design

Reading

Read this section before class. Be prepared with any questions.

In the first century BCE, a Roman engineer named Vitruvius **set forth** three principles of architectural design: firmitatis (firmness), utilitatis (utility), and venustatis (attractiveness).

Today, designers of any kind of product—whether a website, application, or form—still follow these basic principles. For example, for any software product, the business must be sound, the technology useful, and the users **delighted**.

Every designer has their own philosophy and process. But in general, designers try to make complex tasks easier for users. Here are some principles that help them **achieve** this goal:

- ***Be human***: Users are humans, so write like a person—not a robot.
- ***Put users in control***: Users need to be able to go backwards and forwards during a process, or stop without losing their work. Make it easy for users to fix their mistakes.
- ***Be consistent***: Follow **conventions**, terms and patterns that users would expect to see.
- ***Keep it simple***: Let users focus on one action at a time. Show them only what they need at any given time.

Dialogue: Give constructive criticism

Starting with the student, take turns reading this dialogue out loud.

Doug: Hi Mark, I need some help with this presentation. Since you're a designer, do you think you could help me?

Mark: Yes, let's see what I can cover with you in 15 minutes. I think I can give you some general tips.

Doug: Sure, sounds good.

Mark: First, I'm seeing a lot of text, and the slides look **cluttered**. If I were you, I'd reduce the amount of text on each slide.

Doug: So each slide should have one main idea?

Mark: Yes! Exactly. The second thing is that you are using text in places where you could use images to illustrate a point.

Doug: Wait, what do you mean?

Mark: Well, since you're speaking during the presentation, it'll be hard for people to listen to you and read words. So give them something to look at while they listen.

Lesson 17

Principles of Design

Words & Expressions

Review these key terms as they are used in the context of this unit. Discuss any terms that need further explanation.

set forth	제시하다	to give an account or statement of
delighted	아주 기뻐하는	highly pleased
achieve	달성하다	to carry out successfully
convention	관습	the way in which something is usually done within the field
cluttered	어수선한	filled with things in an untidy way
universal	보편적인	related or applicable to all cases

Discussion questions

If you have time, discuss the answers to these questions.

1. Look at the list of design principles again. Based on your experience, there any principles that you would add to the list?
2. Think about different types of design, like web design and user interface design. Are there any design principles that apply to only one type of design? Are any principles truly **universal**?
3. Think of specific examples for one or more of these principles: give feedback, be human, put users in control, be consistent, and keep it simple.

Lesson 18

User Interface Design

Reading

Read this section before class. Be prepared with any questions.

You might not notice a good user interface (UI), but you'll notice a bad one. Whether you're using a website, app, or device, you're using a graphical user interface, or GUI. For instance, when you click or tap on **visible** elements on the screen, like buttons and icons, you're using the GUI. You're also using the GUI when you make gestures like "pinch to zoom" or speak to a virtual assistant. Fonts, colors and animations are also part of GUIs.

So if the GUI is what allows users to accomplish tasks, then UI design is about creating interfaces that allow people to work without even thinking about it. To accomplish this, a UI designer may research, prototype, and test the interface. As part of the "look and feel" of their products, UI designers also have to maintain brand **consistency** and **accessibility** for people with **impairments**.

Dialogue: Describe consequences

Starting with the student, take turns reading this dialogue out loud.

Lauren: Hi Mark, I know it's been crazy around here since we launched the new website. But can I ask, what's the status of the accessibility updates?

Mark: Hi Lauren. No worries. We've added alt text where necessary, and it'll go live this afternoon.

Lauren: Okay, sounds good.

Mark: But there is another problem with the menu templates.

Lauren: What's the problem?

Mark: Well, the navigation menus didn't name the links when we tested it with a screen reader. Instead, it just says "item 1," "item 2" **and so forth**.

Lauren: Hmm. Let's get some developers to look at this. It'll be bad for the company if we receive any complaints about the accessibility of our website.

Lesson 18

User Interface Design

Words & Expressions

Review these key terms as they are used in the context of this unit. Discuss any terms that need further explanation.

visible	보이는	able to be seen
consistency	일관성	something that does not change much across time and space
accessibility	접근성	capable of being reached
impairment	장애	a type of physical or mental condition that limits someone's movements or senses
and so forth	등등	further in the same or similar manner
vehicle	자동차	a means of carrying or transporting something
dashboard	계기판	the part of a car that contains some of the controls used for driving and the devices for measuring speed and distance

Discussion questions

If you have time, discuss the answers to these questions.

1. What are some UI elements that you expect to see when you use an application or website?
2. What's the worst UI you've seen or used? What's the best? (This can include anything from TV remotes to **vehicle dashboards**, not just digital interfaces!)
3. Right now, the trend in UI is "flat" or 2D design. What do you think of this trend? In your opinion, what is the future of UI design?

Lesson 19 User Experience Design

Reading

Read this section before class. Be prepared with any questions.

User experience (UX) design includes everything related to a user's **interaction** with a product. Before developers start building a product or feature, UX designers plan its look and feel with users in mind. They consider the user's needs and expectations to create a product that people enjoy using.

UX design happens throughout the software development life cycle. In every cycle, UX designers continue to learn about the product's users to plan future releases. Here are some examples of what a UX designer might do during the analysis, planning and design phases:

- Collect information from personal interviews, online surveys, and focus groups, which is used to plan and **prioritize** features
- Define **personas** and scenarios: a persona **reflects** a certain type of user, such as "Social Sam" or "Parent Penny", while a scenario shows how the product fits into that persona's daily life
- Create **wireframes** to represent screens or steps that a user might encounter, which will guide developers and UI designers in the build phase
- Create prototypes, which are more **true to life** than wireframes, and use them to conduct testing with actual users

Dialogue: Negotiate a deadline

Starting with the student, take turns reading this dialogue out loud.

Lauren: Hi Mark, I'm getting ready to meet with our largest client. We're gathering feedback on the latest iteration of our product, and I need your help.

Mark: Yeah, I am already working on the wireframes. Is there anything else I can help you with?

Lauren: Well, I know we usually use the wireframes, but I was just wondering… For this client, would you be able to make some prototypes, too?

Mark: I can, but it will take me a little more time.

Lauren: That's all right. How much time do you think it will take? Can you get everything to me by the end of this week?

Mark: Hmm, that might be tight, and I don't want to rush.

Lauren: All right, let's go with this time next week. I don't know what I'd do without you and the other designers.

Lesson 19

User Experience Design

Words & Expressions

Review these key terms as they are used in the context of this unit. Discuss any terms that need further explanation.

interaction	상호작용	the way people and/or systems influence each other
prioritize	우선순위를 정하다	to create order in a system or activity
persona	모습	a role or character
reflect	나타내다	to show the existence or nature of something
wireframe	선구조조도	images that show the functional elements of a screen
true to life	사실적인	accurate representation of real things
description	서술, 묘사	a statement about what someone or something is like

Discussion questions

If you have time, discuss the answers to these questions.

1. What's the difference between user interface (UI) design and user experience (UX) design?
2. If you're not a UX designer, do you know or work with any UX designers in your organization? Does their role match the **description** above? If you are a UX designer, what's your take on your tasks and responsibilities?
3. Imagine that you are a UX designer (if you're not already). How would you feel if users didn't like the final product? What would you do?

Lesson 20

Programming

Reading

Read this section before class. Be prepared with any questions.

Ever tried to solve a Rubik's cube? You can move layers of the cube clockwise or **counterclockwise**, up or down, right or left, front or back. It sounds complicated, right? But the solution to a Rubik's cube can actually be written as a step-by-step procedure, or algorithm.

Now let's say we want to create a program that can automate the process of solving a Rubik's cube. So we'll introduce data and conditional (if–then) statements to our algorithms. After the cube has been scrambled, our program should **retrieve** the current arrangement of the cube layers. Using a series of conditional statements, the program will provide the solution as an output.

As this example **illustrates**, algorithms are fundamental to programming. When we write algorithms using computer languages, we are coding. Computer languages like C++, JavaScript, and Python each offer certain benefits. So software engineers choose which language to based on their goals, company standards, and individual preferences.

Dialogue: Describe progress

Starting with the student, take turns reading this dialogue out loud.

Todd: Good morning! Can you take a look at my code?

Wyatt: Sure. Anything you want me to check for?

Todd: Well, I'm new to this programming language. So I'm not sure I've used the correct indents, line breaks, colors, **et cetera.**

Wyatt: Which source code editor are you using?

Todd: I'm using the one that was already installed on the computer, but I just want to make sure everything is human-readable.

Wyatt: That's good. When someone else comes to rewrite or **refactor** your code, as they **inevitably** do, it'll be great if they can understand it!

Todd: Okay, thanks for your help. you and the other designers.

Lesson 20

Programming

Words & Expressions

Review these key terms as they are used in the context of this unit. Discuss any terms that need further explanation.

counter-clockwise	역시계방향	in the opposite direction of the way clock hands move
retrieve	회수하다, 검색하다	to get something back, especially something that is not easy to find
illustrate	보여주다	to show something by using pictures, diagrams, lists of numbers etc
et cetera	기타 등등	from Latin “and the rest,” used at the end of a list to show that more similar items are included
refactor	컴퓨터코드를 수정하다	to restructure existing computer code
inevitable	불가피한	certain to happen
counter-clockwise	역시계방향	in the opposite direction of the way clock hands move

Discussion questions

If you have time, discuss the answers to these questions.

1. Have you ever left “bugs” in your code on purpose? Why?
2. Which programming languages have you used? What are your favorite programming languages, and why?
3. Have you ever had to rewrite and/or refactor someone else’s code? How would you describe this process?
4. If you have never programmed, discuss your perspective on coding. Does it seem interesting to you? Why or why not?

Lesson 21 Quality Assurance

Reading

Read this section before class. Be prepared with any questions.

In traditional software development, testing is just one step before **deployment**; it's a **last-minute** effort to fix bugs in the code.

But in newer software development models, quality **assurance** (QA) is ongoing. It happens throughout the entire life cycle. From the moment that a client asks for a new feature or program, quality assurance professionals start to evaluate risks. The goal of QA is to prevent problems before they **occur**. This can save a lot of money, because problems are more expensive to fix at later stages of development.

QA professionals also report faults, write test cases, automate tests, and manage data related to testing. Software quality assurance is described in several international standards, including ISO 9000 and IEEE 730.

Dialogue: Express relief

Starting with the student, take turns reading this dialogue out loud.

Calvin: Hi Rose! We've had several incidents of the same kind since the last update. I thought you could look into them for me.

Rose: Are you referring to the **spate** of very odd sell orders that were reported recently?

Calvin: Yes, we're probably talking about the same thing.

Rose: I think I've found the problem. It's a design flaw on the sell screen. I think the traders are switching the quantity and price by accident.

Calvin: Oh… that would make sense. I'm so relieved that you were able to identify this so quickly. I'll report it to the team.

Rose: All good. But hey, we should **expedite** this change request. This is a high-priority issue.

Calvin: I agree. I'll see what I can do.

Lesson 21

Quality Assurance

Words & Expressions

Review these key terms as they are used in the context of this unit. Discuss any terms that need further explanation.

deploy	전개하다	to spread out, utilize, or arrange for a deliberate purpose
last-minute	마지막의	the latest possible time before an event
assurance	보장	confidence or certainty about something
occur	발생하다	to happen or exist
spate	빈발	a large number of similar things or events appearing one after the other
expedite	속도를 더 내다	to make (an action or process) happen more quickly or sooner

Discussion questions

If you have time, discuss the answers to these questions.

1. Can someone work in QA without having programming experience? Discuss.
2. The term “quality assurance” is similar to the term “quality control." Give your opinion on these terms. Do they have different meanings for you?
3. You read that “problems are more expensive to fix at later stages of development.” Have you experienced this during your career? If so, give an example of this kind of problem.

Lesson 22

Software Testing

Reading

Read this section before class. Be prepared with any questions.

After programming, the next step in the software development life cycle is testing. Testers evaluate software systems based on several **criteria**:

- ***Requirements***: Does it **conform** to the design requirements?
- ***Compatibility***: Can it be installed and run in its **intended** environments?
- ***Usability***: Is it usable? This involves observing people use the system in a realistic situation.
- ***Response***: Does it respond correctly to input?
- ***Performance***: Does it work at an acceptable speed?
- ***Goals***: Overall, does it achieve the desired results?

Even though tests have a **comprehensive** understanding of the system, they try to use a program the way customers might. In other words, they try to break it!

Dialogue: Express enthusiasm

Starting with the student, take turns reading this dialogue out loud.

Doug: Hi Nick, how's it going?

Nick: Hi, Doug! Good to see you this morning. I'm just working on some test cases. It's going well.

Doug: Oh, great! What are you testing?

Nick: I'll show you. So, I'm on this log-in screen, and I want to check how the system is handling password **attempts**.

Doug: Cool. Show me what you're expecting to see.

Nick: Okay, so… the user gets three tries to enter the correct password. If they don't get it right the first time, they should see a message asking them to try again.

Doug: Cool. And I'm guessing after the third time, they'll have to reset their password.

Nick: Yes, that's right. And… there it is! Looks like everything's **in working order**.

Lesson 22 Software Testing

Words & Expressions

Review these key terms as they are used in the context of this unit. Discuss any terms that need further explanation.

criteria	기준	principles or standards by which something can be judged or decided
conform	따르다	to agree with rules or standards
comprehensive	포괄적인	complete or nearly complete
intended	의도된	aimed at or trying to reach
attempt	시도	an act of trying to achieve something that is not certain to succeed (or has already been unsuccessful)
working order	정상적으로 작동하는 상태	working correctly, without any problems
exploit	활용하다	to use a situation so that you get benefit from it

Discussion questions

If you have time, discuss the answers to these questions.

1. Software testing is often outsourced to companies in other countries — namely, India, Philippines, China, and Poland. What's your opinion of outsourced testing?
2. Imagine that your company has released a software product with a major security flaw. Whose fault is it? If the product is **exploited**, who must take responsibility?
3. What are the latest trends in software testing?

Lesson 23

Types of Testing

Reading

Read this section before class. Be prepared with any questions.

To evaluate software programs, testers conduct tests on four different levels. From the most basic to the most abstract levels, they are unit, integration, system, and acceptance testing:

- ***Unit*** testing ensures that a piece of code works by itself; this can happen **concurrently** with programming. This is the most basic level of testing.
- ***Integration*** testing **ensures** that the new code works when added to the rest of the system.
- ***System*** testing ensures that the entire system works in its intended environment.
- ***Acceptance*** testing ensures that the program **satisfies** the original design requirements. This is the most abstract level of testing.

Within these levels, testers use several different kinds of testing. Testers perform many tasks manually, but they may also use or write programs that automate parts of the testing process. Some of the most common are as follows:

- ***Functional*** testing focuses on what the program does. The tester puts themselves in the shoes of a user who has no knowledge of how the program is coded.
- ***Non-functional*** testing focuses on how the program works. The tester pushes the program to its **breaking points** of **scalability** or security.
- ***Structural*** testing focuses on the code and structure of the program.
- ***Regression*** testing is the re-testing of a program to find any new problems.

Dialogue: Remind

Starting with the student, take turns reading this dialogue out loud.

Max: Hello Jenny! What are you working on?

Jenny: Hi Max, in brief, I'm debugging my code.

Max: Are you working with reports from the testers?

Jenny: No, although I am expecting to get some soon. Right now I'm just **running through** my own code for problematic lines.

Max: Okay, sounds good. I wanted to remind you that the testers are having a big workshop tomorrow, so there may be a delay in their reports.

Jenny: Oh, cool. I'm sure I can stay busy with the faults I've already found.

Lesson 23

Types of Testing

Words & Expressions

Review these key terms as they are used in the context of this unit. Discuss any terms that need further explanation.

concurrently	동시에	at the same time
ensure	보장하다	to make certain that something happens or is done
satisfy	만족시키다	to fulfill a (desire or need)
breaking point	한계점	a situation in which there are so many problems or so many things to do that a person or organization can no longer deal with them
scalability	확장성	capable of being easily expanded or upgraded on demand
run through	급히 살펴보다	to read (something) quickly or briefly

Discussion questions

If you have time, discuss the answers to these questions.

1. What's the advantage of automating testing? If you have worked in testing, answer based on your experience.
2. What's the best way to test a system or feature? If you could design an ideal way to test something, what would that look like?
3. Functional testing is also called "black-box" testing, and structural testing is also called "white-box" testing. What does this mean? Explain the meaning of black and white boxes.

Lesson 24

Software Maintenance

Reading

Read this section before class. Be prepared with any questions.

As long as your software has users, it's not "finished." Thus, the last phase of the software development lifecycle is maintenance. This phase is just as important as building software. It's also the longest and most expensive phase.

Software maintenance falls under one of four types of maintenance:

1. **Corrective**: The highest priority for developers is fixing bugs in the code. Every software update likely includes some bug fixes.
2. **Preventive**: Hackers never sleep, so software updates often include security patches. Preventive maintenance also includes improving the app's speed and performance.
3. **Adaptive**: Software environments are updated frequently. So applications are also updated to take advantage of new functionality. For example, Apple provides app developers with documentation and software development kits (SDKs) in advance of a new iOS release.
4. **Perfective**: Since the market is a moving target, software products must be updated to keep up. Features are **enhanced**, removed, or added based on user feedback and requirements. Perfective maintenance also includes updates to the "look and feel" of an app.

Dialogue: Apologize for an error

Starting with the student, take turns reading this dialogue out loud.

Jay: Hi, Todd. Can I speak to you for a minute?

Todd: Hey, Todd. Yes, I have some time now.

Jay: I have to apologize for something that happened in the most recent push to production. We're getting dozens of complaints, and I'm afraid it's my fault.

Todd: Yeah, I saw the **spike in complaints** and I figured it was related to yesterday's release. But why do you say it's your fault?

Jay: We wanted to include a new feature that would let users update their email address in the app. But it broke the password reset function. And I wrote the code that's at fault.

Todd: Remember that it's not any one person's fault. We're a team—everyone is equally responsible here. And we'll get through it.

Jay: Thanks for saying that. We're working on the fix now, boss.

Lesson 24

Software Maintenance

Words & Expressions

Review these key terms as they are used in the context of this unit. Discuss any terms that need further explanation.

corrective	수정의	designed to correct something harmful or unwanted
preventive	예방의	designed to keep something undesirable from occurring
adaptive	적응의	designed to adjust to new conditions
perfective	향상하는	designed to achieve perfection
enhance	향상시키다	to increase the quality or value of something
spike in complaints	급격한 불만 증가	an abrupt sharp increase of complaints

Discussion questions

If you have time, discuss the answers to these questions.

1. Why does software require a maintenance phase?
2. What's the most efficient way to maintain software, in your opinion?
3. For developers or engineers: How much of your work time is spent on maintenance? What is your ideal ratio of development to maintenance?

Lesson 25

Unit 25 Maintenance Processes

Reading

Read this section before class. Be prepared with any questions.

As you read in the previous unit, software maintenance is the longest phase of the software development life cycle (SDLC). Within this phase, software maintenance has its own mini life cycle, as follows:

1. ***Identification***: Based on error logs, customer feedback, and new requirements, programmers identify problems and new features.
2. ***Analysis***: Maintenance can be tricky because the application is already in use. So programmers **analyze** proposed changes for their impact on the existing software. Updates must not break the existing product.
3. ***Design***: Programmers plan their approach to the feature or bug fix.
4. ***Implementation***: Programmers write (or rewrite) code and complete unit testing.
5. ***Testing***: The new code is tested within the system to see whether anything breaks as a result. The update is then tested with users and other stakeholders.
6. ***Delivery***: The update is deployed.

Sometimes, the software needs to move to a new platform. In this case, a team of maintenance programmers will complete a **migration** process from one system to another. Sometimes they continue to support the legacy version for some time before retiring it. Once it's been **retired**, the software application is no longer updated. This can happen anywhere from 5 to 15 years after initial development.

Dialogue: Diagnose a problem

Starting with the student, take turns reading this dialogue out loud.

Angela: Hey Harry, I have a report here about our business site. It says that customers are experiencing slow loading times. Can you **diagnose** the problem for me?

Harry: Yes, well… Looking at the error logs, it seems like this is only happening during peak usage times.

Angela: Is it a problem with the site performance?

Harry: Maybe. But the logs also record their web browser, and it looks like only certain browsers are experiencing problems.

Angela: Hmm. Maybe we shouldn't support those browsers. We could say that we only **guarantee** performance on newer versions of browsers X, Y and Z.

Harry: That's one approach. Let me look into the cost of improving our site performance on the **affected** browsers. We can then weigh that against the cost of upsetting our customers.

Angela: Sounds good, Harry. We'll do that before we decide either way.

Lesson 25

Unit 25 Maintenance Processes

Words & Expressions

Review these key terms as they are used in the context of this unit. Discuss any terms that need further explanation.

analyze	분석하다	to study or determine the nature and relationship of the parts
migration	이동, 이행	the process of starting to use a different computer system, or of making someone do this
retire	은퇴하다	to remove something because it is no longer useful
diagnose	진단하다	identify the nature of a problem by looking at the symptoms
guarantee	보증하다	to provide a written or formal assurance that certain conditions shall be fulfilled relating to a product or service
affected	영향을 받다	touched by an external factor

Discussion questions

If you have time, discuss the answers to these questions.

1. What's your experience with software maintenance?
2. Between writing new code and rewriting/refactoring old code, which is easier? Which is better? Give an opinion based on your own work experience, if possible.
3. What is the cost and benefit of maintaining supporting for legacy systems? How does a company decide to stop supporting older versions of their products?

Lesson 26

Virtual Reality & Augmented Reality

Reading

Read this section before class. Be prepared with any questions.

2016 was a **landmark** year for Virtual Reality (VR) and Augmented Reality (AR). In February, Samsung shipped a free Gear VR headset with all pre-orders of Galaxy S7 and S7 Edge mobile phones. Other headsets also came to the consumer market in 2016: PlayStation VR for the PS4, Oculus Rift, and HTC VIVE. In July, the AR app Pokémon Go took over the mobile gaming world, with 500 million downloads by the end of the year.

VR and AR have since become an everyday part of entertainment and gaming. Cafés, movie theaters, and concerts now feature **immersive** VR and AR experiences.

So what is the difference between VR and AR? Both terms describe a computer-generated experience. But VR is totally **simulated**, while AR adds one or two layers of digital information, like a Snapchat face filter. The computer-generated experience of VR and AR can include pictures, sounds, text, and even vibrations.

The concepts of VR and AR are not new. The term "Virtual Reality" was **coined** in 1987; "Augmented Reality," 1990. But recent advances in technology have made it possible to make VR and AR affordable to anyone with a mobile phone.

Dialogue: Give instructions

Starting with the student, take turns reading this dialogue out loud.

Nick: Thanks for coming to our VR trial today. This is called a head-mounted display. It's going to simulate the experience of driving a car.

Lisa: Okay, so I'm going to be driving a car?

Nick: Well, we want to see if our new application feels like driving. So, I want you to put this on, and I will adjust the straps for you for the right fit.

Lisa: All right. Oh! It feels heavy. But it's not uncomfortable.

Nick: Okay, let's get started. I've just turned it on. What do you see?

Lisa: It looks like I'm in a car. Wow… It's like a video game!

Nick: Once it starts moving, I want you to let me know if you start to feel any kind of motion sickness.

Lisa: Okay… What do you mean?

Nick: The risk of VR for some people is **nausea** or dizziness, especially if your eyes aren't seeing what your brain's **vestibular** system "thinks" they should see.

Lesson 26

Virtual Reality & Augmented Reality

Words & Expressions

Review these key terms as they are used in the context of this unit. Discuss any terms that need further explanation.

landmark	획기적인 사건	an event that represents an important turning point for something
immersive	몰입형	showing a first-person 3D image that appears to surround the user
simulated	모조의	imitated or modeled
coin	말을 만들다	to invent a new word/phrase
nausea	메스꺼움	a stomach distress with distaste for food and an urge to vomit
vestibular	전정기관	related to the inner ear or sense of balance

Discussion questions

If you have time, discuss the answers to these questions.

1. Describe your level of experience with VR and AR. Have you ever been to a VR café or watched a movie in VR? Have you ever used an AR mobile app? Do you enjoy VR and AR?
2. VR and AR are popular for entertainment, but this technology has other useful applications. Can you think of some other uses for VR and AR (besides gaming and entertainment)?
3. Are you excited about the future of VR and AR? Make a prediction about the next 10 years of technological development.

Lesson 27

Artificial Intelligence (AI)

Reading

Read this section before class. Be prepared with any questions.

The 2013 American movie “Her” by Spike Jonze showed a **futuristic** society in which people have conversations with AI assistants’ **disembodied** voices. In this movie, the human Theodore and the AI Samantha actually fall in love.

The movie shows AI systems as emotional and complex. In reality, an AI is any software or hardware that responds to **perceived** information in its environment. Possible types of machine “intelligence” include problem-solving, language processing, learning, and reasoning. Some current AI technology includes chatbots, digital assistants, and **autonomous** cars.

In the movie “Her,” Samantha describes herself like this: “What makes me, me is my ability to grow through my experiences. So basically, in every moment I'm **evolving**.” This line represents another important **facet** of AI, machine learning. As the AI gets data, it improves or becomes “smarter.”

This ability to “adapt” is **vital** when the inputs are constantly changing. For example, Google uses machine learning to filter and categorize Gmail inboxes. In another example, the ride-sharing app Uber uses machine learning to match riders to drivers and calculate fares.

Dialogue: Talk to a chatbot

Starting with the student, take turns reading this dialogue out loud.

Chatbot: Hi, Diane! I’m your friendly chatbot for booking flights and hotels.

Diane: I’d like a cheap flight from Seoul to LAX.

Chatbot: So you want to plan a trip to sunny Los Angeles from Seoul, South Korea. What dates are you looking at?

Diane: I prefer sometime next month. I want to depart on a Friday evening or Saturday.

Chatbot: Great, so we’re looking at June. Give me a second while I find the best deals.

Lesson 27

Artificial Intelligence (AI)

Words & Expressions

Review these key terms as they are used in the context of this unit. Discuss any terms that need further explanation.

futuristic	초현대적인	a story set in the future, especially with advanced or even threatening technology
disembodied	누구 목소리인지 알 수 없는	without a body or an obvious physical source
perceived	인지된	recognized through the senses
autonomous	자율적인	having freedom to act on its own
evolving	발전하는	changing gradually
facet	측면	a particular aspect, side, or feature of something
vital	필수적인	essential for function

Discussion questions

If you have time, discuss the answers to these questions.

1. Why do we use quotation marks when we say that a machine “thinks”, “knows”, and “learns”? Can we only use these terms to describe humans?
2. What is your opinion of Siri (Apple), Alexa (Amazon), Cortana (Microsoft), and/or Google Assistant? What is the future of these AI assistants?
3. The movie “Her” represents Artificial Intelligence as capable of relationships and emotions. Is this realistic? Is it also realistic for a human to fall in love with an AI?

Lesson 28 Robotics

Reading

Read this section before class. Be prepared with any questions.

Many science-fiction books and films **depict** robots called "androids" that look and act like people. This is a futuristic vision of robotics, but what isn't futuristic are the robots that are currently exploring the deep ocean and outer space. For example, NASA has had solar-powered rovers on Mars since 2004.

What makes robots so fascinating? A robot is only a machine that can carry out specific actions in physical space. Most robots are programmed for just one task, such as vacuuming the floor. Other robots can complete a dynamic series of actions, such as **repetitive** assembly-line work.

Maybe robots are fascinating because they are complex **feats** of engineering. Or maybe it's because we imagine a future where **anthropomorphic** machines sit next to us at the office or babysit our children. The website "Will Robots Take My Job?" states that half of the U.S. market as of 2013 could be automated by 2024.

But supporters of robotics argue that robots will only replace jobs that are **menial** (data entry) or dangerous (nuclear power plant operation). Assembly-line robots are already used for **intricate** work such as making car parts, electronics, and medicines. Using robots will only give humans more time and energy to learn about our world, our universe, and ourselves.

Dialogue: Argue a point

Starting with the student, take turns reading this dialogue out loud.

Referee: Greg, that's a foul. RoboRef has shown a yellow card.

Greg: Are you kidding me? I'm having trouble believing that the robot is right.

Referee: I'm sorry, Greg, but you know the rules.

Greg: This is crazy! This little machine didn't see me properly, I'm telling you.

Referee: Do you want me to show you the replay? We have it from all camera angles. I don't think you want to argue about this.

Greg: The robot doesn't like me.

Referee: Don't be **ridiculous**. The point of RoboRef is that it's not biased!

Lesson 28

Robotics

Words & Expressions

Review these key terms as they are used in the context of this unit. Discuss any terms that need further explanation.

depict	묘사하다	to show with words or pictures
repetitive	반복적인	involving repeating the same thing over and over, especially something tiring
feat	위업	a great achievement of skill, strength, or knowledge
anthropo-morphic	사람과 유사한	from Greek, “in the form of a human being”; having human characteristics
menial	하찮은	involving a low level of skill or education
intricate	복잡한	very complicated or detailed
ridiculous	어리석은	extremely silly or unreasonable

Discussion questions

If you have time, discuss the answers to these questions.

1. What is the main difference between an AI and a robot?
2. What is the role of robotics in the modern economy? What do you think of the idea that “robots will take our jobs”?
3. In your opinion, what is the most interesting or exciting application of robotics in science today?
4. Are you afraid that robots could be too much like humans in the future? Is this realistic, or is just science fiction?

Lesson 29 Blockchain

Reading

Read this section before class. Be prepared with any questions.

Almost everyone has heard of bitcoin. In 2017, the value of a single bitcoin **spiked** to nearly US$18,000 . Many countries have had to decide whether to regulate bitcoin and other **cryptocurrencies**, or even make them illegal.

But bitcoin is only a shadow of its technology, called blockchain. The World Economic Forum estimates that 10 percent of the world GDP will be stored on the blockchain by 2025 .

In technical terms, a blockchain is a set of digital records ("blocks") that are **encrypted** ("hashed") with private and public keys. The records are ordered in a linear chain according to their time stamp. None of the blocks can be modified because they rely on the blocks that came before them in the chain. The blockchain is distributed across many different computers ("nodes"), and each node provides a small part of the storage, power, and bandwidth needed to maintain the blockchain. Therefore, blockchain technologies remove the need for a **centralized** authority to maintain accurate records. The records cannot be hacked, changed, or deleted.

Blockchain has many applications. Because it is digital, transparent, and secure, blockchain is valuable to industries such as healthcare, insurance, and music. People have already **adopted** blockchain technology to store and track data about diamonds, fine art, cars, real estate, and more.

BLOCKCHAIN FOR GOOD

The United Nations World Food Program launched a blockchain project called "Building Blocks." In 2018, they sent Ethereum vouchers to Syrian refugee camps in Jordan. The **refugees** could **redeem** the vouchers to buy food at the camp market. Their identities were verified using an eye scanner, so the vouchers couldn't be sold or traded. This p roject was a "trial run" to show how blockchain can be used for humanitarian aid.

Dialogue: Give a sales pitch

Starting with the student, take turns reading this dialogue out loud.

Lauren (Company Representative): How comfortable are you with blockchain?

Client (Marketing): Well, I have done some research on the subject, but I haven't used it myself.

Lauren: Good to hear. I'd love to tell you more about blockchain and how it can change your entire approach to marketing.

Client: Sure. I'm curious.

Lauren: Well, blockchain technology cuts out the "middle man." How much of your budget goes straight to ad platforms?

Client: Yes, the return on marketing expenditure isn't great. But I don't really understand how we could go directly to the customer.

Lesson 29

Blockchain

Lauren: Well, we have a large and growing base of users who participate in a marketing blockchain. They are compensated for sharing their personal data—

Client: How do you convince them to share their personal data?

Lauren: They don't have to "trust" the company, because blockchain gives them ownership over their data.

Words & Expressions

Review these key terms as they are used in the context of this unit. Discuss any terms that need further explanation.

spike	상승하다	to peak; to increase and then decrease sharply
cryptocurrency	가상화폐	any form of currency that only exists digitally, that usually has no central is suing or regulating authority
encrypt	암호화하다	to convert data/information to code to prevent unauthorized access
centralized	중앙화된	brought into one place
adopt	채택하다	to choose to take/follow an idea or method
refugee	난민	a person who flees to a foreign country or power to escape danger or persecution
redeem	교환하다, 보완하다	to exchange for something of value

Discussion questions

If you have time, discuss the answers to these questions.

1. Would you buy cryptocurrency, like bitcoin, Litecoin, and Ethereum? What are the risks and benefits of buying cryptocurrency?
2. Should cryptocurrency be legal? What are some reasons why a country might make cryptocurrency illegal?
3. The lesson mentioned some uses for blockchain technology, like humanitarian aid and marketing. Can you think of some other applications?

Lesson 30

Internet of Things (IoT)

Reading

Read this section before class. Be prepared with any questions.

Smart watch, smart home, smart car — it seems like anything and everything could be "smart." Even Barbie dolls can be connected to the cloud! These "smart" devices are all part of the **Internet of Things (IoT)**.

IoT is as a system of devices that share data to the cloud using cellular, Bluetooth, Wi-Fi, Ethernet, or satellite. An IoT device can be anything that receives information from its environment, such as an **accelerometer** for measuring speed or a thermometer for measuring temperature. Users can set rules for the device, receive alerts from it, and control it **remotely**.

IoT has a wide range of applications. The most familiar type of IoT device may be wearables, such as smart watches and fitness trackers. Companies are also developing smart **textiles** for athletes and patients. Another type of consumer IoT is already in many homes: water meters, security systems, thermostats, lightbulbs, TVs, speakers and even cookware can all be "smart."

IoT has also been adopted by industries as diverse as agriculture, healthcare, and **logistics**. Even if IoT requires a significant **startup** investment, using the appropriate technology could improve health, reduce waste, and save energy.

Dialogue: Explain the difference

Starting with the student, take turns reading this dialogue out loud.

Todd: Hi Heather! Did you see the news about the LTE Cat-M1?

Heather: Yeah, you tell me about this new Internet network? I don't really understand it.

Todd: It's for Internet of Things!

Heather: For what?

Todd: Smart devices. Like tracking devices, health monitors, stuff like that.

Heather: Wait, but how is it different from regular LTE? Why do we have this new network?

Todd: Good question. LTE is best for mobile phones, but this new network is ideal for smart devices

Heather: Can you give me an example?

Todd: Let's say a diabetic person has a blood sugar monitor. It's constantly sending a small amount of data. Regular LTE would drain the battery quickly.

Heather: But LTE Cat-M1 is better?

Todd: Yes, it's more efficient for the device, and actually cheaper. This network is just for IoT.

Lesson 30

Internet of Things (IoT)

Words & Expressions

Review these key terms as they are used in the context of this unit. Discuss any terms that need further explanation.

IoT	사물인터넷	Internet of Things
accelerometer	가속도계	an instrument for measuring acceleration or for detecting
remotely	원격으로	from a distance or without physical contact
textile	직물, 옷감	a cloth or fabric
meter	계량기	a device that measures and records the amount of something used, especially electricity, gas, or water
logistics	물류	system of transporting goods to customers

Discussion questions

If you have time, discuss the answers to these questions.

1. Do you own any “smart” devices like a watch or TV?
2. What are the benefits of “smart” devices and IoT technology? What are the risks?
3. Think of an IoT device or feature you’d like to see in the future. Use your imagination!

Lesson 31

Project Life Cycle

Reading

Read this section before class. Be prepared with any questions.

"Life cycle" is a **figurative** term to describe the beginning, middle, and end of something. In this case, every project has a life cycle with four distinct **phases**: initiation, planning, execution, and closure. Every project has a project manager, or PM.

The first phase is called "initiation." In this phase, the PM will test the **feasibility** of the project and identify its scope. The scope is the answer to questions like, "What problem does this project solve?" Defining the scope is critical to the success of the project.

The PM needs to make the business case to **stakeholders** and get approval before moving on to the next phase. After the project is approved, it moves into the "planning" phase. In this phase, the PM will create a formal document that outlines the objectives, deliverables, and milestones of the project. The PM may also create a visual timeline like a Gantt chart, a communication schedule, a risk management plan, and a budget.

The next phase of the project, the "execution" phase, will kick off with a team meeting. This phase **commences** work on the deliverables and goals. The PM adjusts the project plan according to Key Performance Indicators, like cost, effort, quality, and time.

The last phase, "closure," starts when the project's goals have been achieved. In this phase, the PM does a **post mortem** to discuss which aspects of the project went well and which didn't. The PM then prepares a final report to the stakeholders.

Dialogue: Confirm a plan

Starting with the student, take turns reading this dialogue out loud.

Harry: Hi Angela, we need to make a cost estimate for a project from a new client. I just wanted to ask you whether you wanted me to go ahead with the bid.

Angela: Do you have the request for tenders?

Harry: Yeah, I'll send it to you so you can see all the project **specifics**. The deadline for the **tender** is still a few months away, so we have time to put in our bid.

Angela: And when is the deadline for completing the project?

Harry: It's still 18 months away. I think we have a good chance at winning the contract.

Angela: Yeah, let's make sure we understand everything the client needs before we start working on the Project Initiation Document.

Harry: Of course. I'll send you all the details right away.

Lesson 31

Project Life Cycle

Words & Expressions

Review these key terms as they are used in the context of this unit. Discuss any terms that need further explanation.

figurative	비유적인	not used in the literal sense
phase	단계	a distinct period/stage in a development process
feasibility	실현 가능성	how easy it is to do something
stakeholder	이해 당사자	a person with an interest in something (usually business-related)
commence	시작하다	to begin; to start
post mortem	사후의	“after death” in Latin; an analysis or discussion of an event (especially a failure) to determine what happened
specifics	구체적인것들	details
tender	입찰	an offer of a bid for a contract

Discussion questions

If you have time, discuss the answers to these questions.

1. What is a Key Performance Indicator (KPI)? In your opinion, what’s the most important KPI in a project?
2. Have you ever participated in a project that failed? Why did it fail? In general, what are some reasons that projects fail?
3. What are the traits of a good project manager?

Lesson 32

Product Management

Reading

Read this section before class. Be prepared with any questions.

“Good product managers take full responsibility and measure themselves in terms of the success of the product.”

This quotation is from a memo by Ben Horowitz, an American **entrepreneur** who was the Vice President and General Manager of Hewlett-Packard before starting his own venture capital firm.

Product management lies at the **nexus** of engineering, marketing, and sales and support. Because they see the **comprehensive** picture of the product’s features and functions, the product manager is the **go-to** person for questions about the product.

Product managers provide strategy and vision for the company’s products, including mobile apps, websites, and software. Their day-to-day job is to meet with customers to gather requirements and guide engineering/development teams in building and refining features.

Product managers are also responsible for writing Product Requirements Documents (PRD). The PRD is a roadmap for bringing the product to market.

Dialogue: Express confidence

Starting with the student, take turns reading this dialogue out loud.

Jay: Hi, Jennifer, thanks for meeting me.

Jennifer: Good afternoon, Jay! How can I help you?

Jay: I wanted to get some **clarification** about the new technical requirements you’ve added to the PRD since your client meeting last week.

Jennifer: Sure. The big picture is that they want to add another **integration** function. I’ve already added the requirements as user stories in Jira.

Jay: Okay, let me think about how to **implement** this new function. Are they still pushing for the original deadline?

Jennifer: Yes, they are. But I have full confidence in you and the other developers. Remember, I’m here to answer all of your questions.

Jay: Thanks, Jennifer. Will do.

Lesson 32

Product Management

Words & Expressions

Review these key terms as they are used in the context of this unit. Discuss any terms that need further explanation.

entrepreneur	기업인	one who organizes, manages, and assumes the risks of a business or enterprise
nexus	연계점	a central point where different things connect
comprehensive	포괄적인	related to almost all aspects of something
go-to	조언을 구하는	regularly sought out for a particular situation
clarification	명료화	the act of making something more understandable or less confusing
integration	통합	bringing components into one system
implement	실행하다	to put into effect/action

Discussion questions

If you have time, discuss the answers to these questions.

1. What's the difference between project management and product management?
2. Re-read the quotation from Ben Horowitz: "Good product managers take full responsibility and measure themselves in terms of the success of the product." What does this mean to you?
3. Does your company have a product owner/manager? Do you interact with them?

Lesson 33

Change Management

Reading

Read this section before class. Be prepared with any questions.

Imagine if your company wanted to **migrate** its website to a new platform. What questions come to your mind? “How long will it take? How much will it cost? How will people react? What are the risks?”

Answering these questions is part of change management: How to introduce and implement something new. This can be a process, tool, product, or goal. Successful change management depends on several factors, according to the 1999 “ADKAR” model by Jeff Hiatt from Prosci:

1. **A**wareness for the need to change
2. **D**esire to support and participate in the change
3. **K**nowledge of how to put the change into effect
4. **A**bility to **execute** the change
5. **R**einforcement to make the change “stick”

Change management can be handled by a dedicated change manager or a project manager, depending on the scope (complexity) of the change.

Dialogue: Confirm information

Starting with the student, take turns reading this dialogue out loud.

Harry: Hi Angela, our new change manager is working on the plan for moving our services to the cloud.

Angela: That’s great. Can you tell me what her plan will include?

Harry: Yes, I’ve asked her to include plans for testing, communicating, scheduling, documenting, and evaluating the change.

Angela: Please tell me your own thoughts around evaluating the change. We’ve already decided that this is a good move, based on the market. But how do we know it will stick?

Harry: Sure. I hired this change manager because of her successful **track record** of implementing long-lasting change.

Angela: Good to know.

Harry: I can see that she has a good sense of our company culture, so I trust her to make a **workable** plan. I will ask you to **sign off** on the final draft of her plan, once it’s complete.

Lesson 33

Change Management

Words & Expressions

Review these key terms as they are used in the context of this unit. Discuss any terms that need further explanation.

migrate	옮기다	to change from one system to another
execute	실행하다	to carry out a plan
reinforcement	강화	something that strengthens or encourages something
track record	실적	the past performance and achievements of a person, organization, or product
workable	실현 가능한	able to get the desired results in a practical way
sign off (on)	승인하다	to officially approve something

Discussion questions

If you have time, discuss the answers to these questions.

1. Have you ever been working on a project that changed significantly before it was completed?
2. How do you respond to change, in general? Do you prefer stability over change?
3. What kinds of changes has your company experienced in the last 1-3 years?

Lesson 34

Stakeholder Management

Reading

Read this section before class. Be prepared with any questions.

Let's say you want to buy a house. Think about some of the factors that might affect your decisions: the size of the house, the neighborhood **amenities**, and the distance to a school. Now make a mental list of the people involved: you, your spouse, your children, your parents, your new neighbors, and even your friends. What if your parents want you to live close to them? What if you and your spouse disagree on the number of bedrooms your house should have?

Whether you're buying a house or launching a new software product, managing the needs and expectations of everyone involved is a complicated, even emotional job. This task is called stakeholder management.

In business, stakeholders can include organizations as well as individuals—anyone who is affected by the outcome of a project can be considered a "stakeholder." Stakeholders are generally categorized by their level of interest versus their influence. In the example of buying a house, your spouse would have a lot more influence than your friends.

The most important part of stakeholder management is communication. After you identify their needs and motivations, you need to plan to **keep** them **in the loop**. Consistent communication between your team and the stakeholders will minimize risks and maximize opportunities for success.

Dialogue: Address concerns

Starting with the student, take turns reading this dialogue out loud.

Harry: We **covered a lot of ground** with our internal stakeholders in the last **steering committee** meeting, but I think it's time to give the external stakeholders some more attention.

Angela: I agree. What's next in the plan?

Harry: We need to organize our next quarterly meeting. I'll send the invitation as soon as I set a date and time. But they've sent me some concerning emails lately.

Angela: Do you think we have anything to worry about?

Harry: Well, I'm afraid that some of key stakeholders are becoming **cynical** about the project. I'm afraid that pushing back the deadline will make them drop their support.

Angela: Harry, thanks for **bringing** this **up**. Give me the names, and I will call them to give them a chance to express their concerns.

Harry: Great. We need to manage their expectations about the timeline of this project. It's not going to happen **overnight**.

Lesson 34

Stakeholder Management

Words & Expressions

Review these key terms as they are used in the context of this unit. Discuss any terms that need further explanation.

amenity	편의시설	a desirable or useful feature or facility
keep in the loop	계속 정보를 교환하다	to furnish someone with sufficient relevant information and include them in the decision-making process.
cover ground	상세하게 논하다	to discuss a certain amount of information
steering committee	운영위원회	a managing or directing committee
cynical	냉소적인	feeling uncertain about whether something will or should happen
bring up	환기시키다,	to bring to attention
overnight	졸지에	very quickly

Discussion questions

If you have time, discuss the answers to these questions.

1. What groups, organizations, and projects are you a stakeholder in? Explain what makes you a stakeholder.
2. How would you manage stakeholders who have a negative view of your project? Would you treat them differently if they had a positive view?
3. Have you ever participated in a project that failed (or succeeded) because of a key stakeholder?

Lesson 35

Team Management

Reading

Read this section before class. Be prepared with any questions.

In the American **comic strip** “Dilbert” by Scott Adams, an office worker named Dilbert **endures** a **corrupt**, lazy manager. The strip **satirizes** technology and the corporate workplace. This quote from a 1993 strip represents the boss’s take on team management: “In order to build team spirit, I’ve decided you should have lunch together once a week. I won’t be there myself because…it’s my job to motivate, not **get bogged down** in the details.”

This approach to team management is obviously ineffective. But what is the **hallmark** of good team management?

Just as a good product manager takes responsibility for the success of the product, a good team manager will take responsibility for the success of the team. One simple tactic that has been proven to improve performance is to show **appreciation**. Another is to let the team know how their work has helped the company grow.

The team manager is responsible for guiding new teams. In general, high-performing teams are able to share skills, work towards strategic goals, and learn from each other. With oversight from an effective manager, team members understand their roles within the team and follow established processes.

Dialogue: Disagree with an opinion

Starting with the student, take turns reading this dialogue out loud.

Harry: Hi Jay, I want to **popcorn** some ideas with you about the homepage of our app.

Jay: Sure, what do you think?

Harry: When you look at it, where do your eyes go?

Jay: Um… Are you suggesting it’s too crowded?

Harry: Well, our recent user feedback suggests that the homepage has too much information. They are spending a lot of time looking at the homepage before taking an action.

Jay: That sounds like a problem, but do you know how much work has already gone into that screen? We’ve spent a lot of time on it.

Harry: I know, I know. But I would like to ask you and the other developers to work on some revised designs before our next release.

Jay: We can do that, but I’m afraid we’re taking a step backward.

Harry: I understand your concerns. How do you feel about working on it as a team in our next **sprint**?

Lesson 35

Team Management

Words & Expressions

Review these key terms as they are used in the context of this unit. Discuss any terms that need further explanation.

comic strip	연재만화	a group of cartoons in narrative sequenc
endure	견디다, 인내하다	to suffer something difficult, especially with patience
corrupt	비도덕적인	morally degenerate and perverted
satirize	풍자하다	to make fun of something while criticizing it
get bogged down	꼼짝 못하게 되다	to be unable to make progress
hallmark	전형적인 특징	a characteristic mark of excellence
tactic	전략	a strategy for achieving a goal
appreciation	감사, 공감	a feeling or expression of admiration, approval, or gratitude
popcorn	아이디어를 떠올리다	to brainstorm ideas by speaking out spontaneously
sprint	전력질주	(in software development) a short period of time for completing planned tasks

Discussion questions

If you have time, discuss the answers to these questions.

1. Do you like working as part of a team?
2. What is satire? Like the Dilbert comic, have you seen any satire?
3. As a team member, have you ever disagreed with the team manager? Describe the situation and the outcome.

Lesson 36

Problem-Solving

Reading

Read this section before class. Be prepared with any questions.

Imagine that the sales department in your organization uses a lot of paper every day. They are spending a lot of time completing and filing paperwork. Now imagine that your manager asks you to find a solution to this "paper problem." What do you do?

Your **approach** to the situation depends on your problem-solving skills. If you decide to build a software program that digitizes the paperwork, is this really going to **address** the problem? Before making a decision, you need to follow a problem-solving process.

The first step in the problem-solving process is to define the problem: What's the **big deal**? Ask yourself why this problem exists, who it affects, and whether it's happened before. As part of your analysis, collect data about the problem.

Once you understand the **scope** of the problem, start generating possible solutions. For each solution, consider whether it would be permanent or temporary and how it would affect various stakeholders. Think about what kind of resources you would need to implement it.

Finally, start testing your solutions. Based on the results of your testing, refine your solutions until you find the best one. As you test each solution, document it so that other people can understand your decision-making process.

Problem-solving is an important "soft skill" that everyone can benefit from practicing, no matter your job title, department, or industry.

Dialogue: Prioritizing tasks

Starting with the student, take turns reading this dialogue out loud.

Jenny: I wanted to discuss some problems we've identified in the latest software update. Some of them will be simple **fixes**, but some of them are more significant.

Harry: I agree. Let's make a list of all of the problems first, and then we can prioritize them.

Jenny: Okay, I've already got the list here. Which problems do you think are most important?

Harry: Since the latest update, some of the users haven't been able to log in. This issue seems like a high-priority problem. But we still need to assign priority to all of the problems before we start working on this one.

Jenny: Okay, makes sense. What's the next step after we assign priority?

Harry: We'll ask the team to look at all the high-priority problems. Since we don't know yet what's causing all of these problems, we can split them into smaller steps to make them more manageable.

Jenny: And while addressing the high-priority problems, they may also end up solving some of the medium and low-priority problems.

Lesson 36

Problem-Solving

Words & Expressions

Review these key terms as they are used in the context of this unit. Discuss any terms that need further explanation.

approach	접근방법	a way of dealing with a situation or problem
address	다루다	to deal with an issue or problem
big deal	큰 문제	the most important or essential aspect of a situation
scope	범위	the extent of the topic or subject that something relates to
fix	쉽거나 잠정적인 해결책	something that fixes or restores

Discussion questions

If you have time, discuss the answers to these questions.

1. Discuss the “paper problem” from the reading. How would you solve this problem?
2. Think about a problem you recently had at work. Describe the problem and how you solved it. What process did you use?
3. What is a “soft skill”? Besides problem-solving, what are some other important soft skills?

Lesson 37

Conflict Resolution

Reading

Read this section before class. Be prepared with any questions.

Think of the last time you had a serious disagreement or argument with someone at work. If it's easy to remember the details of a specific incident, that's because conflicts are often emotional and stressful.

Workplace conflicts don't have to be negative. Conflicts can be productive if they increase collaboration. But when they aren't resolved, they can hurt **morale**.

Conflict happens for different reasons. Some conflicts are **interpersonal**, such as when someone feels disrespected, betrayed, or threatened. Other conflicts arise when people disagree on which methods to use, how to distribute resources, and which goals to prioritize. For example, if a department is facing a budget cut next year, the managers in the department might disagree over how to use the money.

Conflicts in the workplace are nearly **inevitable**. So instead of trying to prevent conflict, it's best to focus on learning how to manage and resolve conflict. Conflict resolution requires people to use a range of soft skills, including **empathy**, communication, problem-solving and collaboration. Understanding how other people feel, what they think and what they want will help you resolve conflicts at work.

Dialogue: Express concerns

Starting with the student, take turns reading this dialogue out loud.

Jenny: Harry, while we're meeting, I wanted to ask you something I noticed in yesterday's team meeting.

Harry: Sure, what's wrong?

Jenny: Although I respect your position as the manager, I felt that the team and I didn't get a chance to share our opinions during the meeting. Instead, we were just told what to do.

Harry: Jenny, I'm sorry to hear that. It's important to me that all team members feel free to express themselves. Can you tell me more about how you felt and what you would like to see instead?

Jenny: I felt frustrated. In the future, I want to be able to ask questions and provide any **insights** I might have.

Harry: Thanks for sharing this with me. I understand what you're saying. What do you think I can do to improve the way I lead meetings?

Jenny: When we have meetings, I would recommend asking everyone to share one-by-one, even if we are **pressed for time**. That way, we feel that we are all valued members of the team.

Lesson 37

Conflict Resolution

Words & Expressions

Review these key terms as they are used in the context of this unit. Discuss any terms that need further explanation.

morale	사기	a group's confidence, enthusiasm, and discipline
interpersonal	대인관계에 관련된	about the relationship between or among people
inevitable	불가피한	incapable of being avoided or evaded
empathy	공감	the ability to understand how another person is feeling
insight	통찰력	an accurate and deep understanding of something
pressed for time	시간에 쫓겨	to be in a hurry; to not have much time to do something
mediate	중재하다	to step into the middle of a conflict and bring agreement

Discussion questions

If you have time, discuss the answers to these questions.

1. What are the most important skills for resolving conflicts?
2. Do you find it easy or difficult to resolve conflicts at work?
3. Have you ever **mediated** a conflict between two of your colleagues? Describe this experience.

Lesson 38

Communication Skills

Reading

Read this section before class. Be prepared with any questions.

"When I talk about a skills gap…what's the first thing that comes to mind?"

During a 2018 interview with Wired magazine, LinkedIn CEO Jeff Weiner discussed which skills are **in** high **demand**. He said that many employers are looking for people with strong communication skills and other soft skills. In fact, even though the tech industry is **booming**, non-technical skills represent a big "skills gap."

It's not hard to see the importance of communication skills. Sending emails, participating in team meetings, and writing documents; these interactions all **rely on** employees' communication skills. But as more employers are starting to value strong communication skills, they can't always find people with these abilities.

The easiest way to improve your communication skills is by focusing on other people. Pay attention to what they are saying. Make sure you understand them before you **respond**. Think about how they will feel when they read or hear your words. Using these strategies, you will become a better listener and a better employee.

Dialogue: Give instructions

Starting with the student, take turns reading this dialogue out loud.

Harry: Jenny, I'd like you to review some code when you get a chance. Do you have time this week?

Jenny: I do have time. Who is it for?

Harry: We have a new programmer, Max. Can you check whether he is following the style guidelines?

Jenny: Sure, what shall I do if I find a major problem with his code? How should I break the news?

Harry: Good question. Although the success of the project comes first, people are often sensitive about their own coding! Just **put yourself in his shoes** when writing your comments, and you'll be fine.

Jenny: That makes sense. I think if I find anything serious, I would talk to Max **in person** so I can understand his thought process.

Lesson 38

Communication Skills

Words & Expressions

Review these key terms as they are used in the context of this unit. Discuss any terms that need further explanation.

in demand	수요가 있다	needed or wanted by many people
booming	급속히 발전하는	suddenly increasing; growing rapidly
rely on	의지하다	to depend on
respond	반응하다	to say something in return : make an answer
break the news	좋지 않은 소식을 전하다	to share important but upsetting information
put oneself in a person’s shoes	남의 입장이 되어 생각하다	to imagine that you are in the situation someone else is in
in person	직접	by meeting with someone face-to-face instead of emailing, calling, or writing a letter

Discussion questions

If you have time, discuss the answers to these questions.

1. Do you see a connection between communication skills and your job? Give an example of how you use communication skills at work.
2. How do you feel when you receive constructive criticism from a coworker or manager?
3. Do you agree that communication and other “soft skills” represent the biggest “skills gap”? What can we do to overcome the skills gap?

Lesson 39

Presentations

Reading

Read this section before class. Be prepared with any questions.

Almost everyone has to give a presentation at some point in their career. Presentations are essential for sharing research findings, announcing product releases, and **pitching** to clients. But to give an effective presentation, you need advanced communication skills.

One of the best presenters in recent history is Steve Jobs, known for his **keynote** (or “Stevenote”) address at the annual Apple World Wide Developers Conference (WWDC). His presentations are admired because they informed, inspired, and entertained the audience:

1. To inform your audience, avoid using words in your slideshows. Use visuals whenever possible.
2. To inspire your audience, show excitement about your product or topic. Smile, show confident body language, and use positive words like “amazing” or “innovative.”
3. To entertain your audience, use humor to “break the ice” and relate to your audience. Make sure to keep eye contact when speaking.

Following these principles will help you deliver persuasive, effective presentations.

Dialogue: Conclude a presentation

Starting with the student, take turns reading this dialogue out loud.

Harry: That’s the end of my presentation. To **recap**, I covered the new features from our most recent product release. Does anyone have a question for me?

Client: Can you tell me more about what kind of user data you’re collecting?

Harry: Sure. We’ve always stored user data securely. And in this release, we’ve actually **trimmed** the registration form so we’re only collecting the most essential data.

Client: Thanks for explaining, Harry. I’ve been thinking about data privacy recently, especially within our business.

Harry: That’s a **valid** concern. Thanks for your time today, and I hope to meet again soon.

Lesson 39

Presentations

Words & Expressions

Review these key terms as they are used in the context of this unit. Discuss any terms that need further explanation.

pitch	홍보하다, 겨냥하다	to try to obtain a contract or other business
keynote	기조	setting the theme for a conference
recap(itulate)	개요를 말하다	to restate again, as a summary (short for “recapitulate”)
trim	다듬다	to reduce the size, amount, or number of something
valid	타당한	reasonable; logical
One-liner	짤막한 농담	a very succinct joke
entice	유도하다	to interest someone by offering them something

Discussion questions

If you have time, discuss the answers to these questions.

1. What do you do to prepare for presentations?
2. Do you get nervous when you have to give a presentation? What do you do to stay calm?
3. What is your opinion about making jokes or using **one-liners** to **entice** the audience?

Lesson 40

Ethics

Reading

Read this section before class. Be prepared with any questions.

Within 10 years of the invention of the first programmable computer , scientists were already thinking about the future **societal implications** of computing technology . They asked themselves questions about crimes committed using computers, like bank **fraud**.

These discussions about what is now known as “computer ethics.” In recent years, computer **ethicists** have turned their attention to “Big Data,” artificial intelligence, and machine learning. They have asked questions like:

- “Do people own their personal data?”
- “Who is responsible if a self-driving car fails?”
- “Should we make decisions based on machine output?”

Both the IEEE and the ACM have a code of ethics for ICT professionals. The general principles are to be honest, fair, and respectful of intellectual property, privacy, and confidentiality. The overarching principle of computer ethics is to work for the **public good** and to avoid harm.

DATA ETHICS

A subset of computer ethics concerns data. In May 2018, the European Union enacted the General Data Protection Regulation (GDPR). This law improves transparency around the ways companies collect, store, and use data. Some recommendations are to gather only the information you need, take steps to protect it, and let people access or delete their data.

Dialogue: Explain a policy

Starting with the student, take turns reading this dialogue out loud.

Harry: Hi, Max, welcome to the company. Since you’re new here, I wanted to give you an orientation to our most important company policies and procedures.

Max: Thanks, Harry. I’d be happy to have your help! What’s first?

Harry: Well, as you’re starting to write code for us, I want to emphasize the importance of intellectual property rights.

Max: Uh… Can you give me an example?

Harry: Yeah. As we’re developing our software, we’re creating original information — “trade secrets.” So we can’t share that with anyone outside of the company.

Max: And I’m guessing it works the other way, too? Like, we can’t use code from other copyrighted software.

Harry: Certainly not. I don’t mean to scare you, but the company can be held **liable** if any of our employees violate these guidelines. I’ll send you a copy of all of the policies later.

Lesson 40

Ethics

Words & Expressions

Review these key terms as they are used in the context of this unit. Discuss any terms that need further explanation.

societal	사회의	of or relating to society
implication	영향	a likely consequence of something
fraud	사기	wrongful or criminal deception intended to result in financial or personal gain
ethicist	윤리학자	someone who makes judgments and recommendations about behavior
overarching	지배적인	comprehensive; applies to everything
public good	공익	the benefit of all people
liable	법적 책임이 있는	responsible by law

Discussion questions

If you have time, discuss the answers to these questions.

1. What is “data ethics”? How much concern do you feel about your own data privacy?
2. Has your company adopted a specific code of ethics?
3. In your opinion, what ethical problem within ICT is the most difficult to solve?