Describe Artificial Intelligence workloads and considerations

(20— 25%)

Automated machine learning	This feature enables non-experts to quickly create an effective machine learning model from data.
Azure Machine Learning designer	A graphical interface enabling no-code development of machine learning solutions.
Data and compute management	Cloud-based data storage and compute resources that professional data scientists can use to run data experiment code at scale.
Pipelines	Data scientists, software engineers, and IT operations professionals can define pipelines to orchestrate model training, deployment, and management tasks.

Identify features of common AI workloads

- **identify features of anomaly detection workloads**

  Anomaly detection is a machine learning-based technique that analyzes data over time and identifies unusual changes.

Anomaly Detector service provides an application programming interface (API) that developers can use to create anomaly detection solutions.

- **identify computer vision workloads**

  Computer Vision: You can use this service to analyze images and video, and extract descriptions, tags, objects, and text.

  Custom Vision: Use this service to train custom image classification and object detection models using your own images.

  Face: The Face service enables you to build face detection and facial recognition solutions.

  Form Recognizer: Use this service to extract information from scanned forms and invoices.

- **identify natural language processing workloads**

Language: Use this service to access features for understanding and analyzing text, train language models that can understand spoken or text-based commands, and build intelligent applications.

Translator: Use this service to translate text between more than 60 languages.

Speech: Use this service to recognize and synthesize speech, and to translate spoken languages.

Azure Bot: This service provides a platform for conversational AI, the capability of a software "agent" to participate in a conversation. Developers can use the *Bot Framework* to create a bot and manage it with Azure Bot Service - integrating back-end services like Language, and connecting to channels for web chat, email, Microsoft Teams, and others.

- **identify knowledge mining workloads**

Knowledge mining is the term used to describe solutions that involve extracting information from large volumes of often unstructured data to create a searchable knowledge store.

One of these knowledge-mining solutions is **Azure Cognitive Search**, a private, enterprise, search solution that has tools for building indexes.

Azure Cognitive Search can utilize the built-in AI capabilities of Azure Cognitive Services such as image processing, content extraction, and natural language processing to perform knowledge mining of documents. The product's AI capabilities make it possible to index previously unsearchable documents and to extract and surface insights from large amounts of data quickly.

Identify guiding principles for responsible AI

- **describe considerations for fairness in an AI solution**

  AI systems should treat all people fairly based on gender, ethnicity, or other factors that result in an unfair advantage or disadvantage to specific groups of applicants.

- **describe considerations for reliability and safety in an AI solution**

  AI systems should perform reliably and safely. AI-based software application development must be subjected to rigorous testing and deployment management processes to ensure that they work as expected before release.

- **describe considerations for privacy and security in an AI solution**

  AI systems should be secure and respect privacy. The machine learning models on which AI systems are based rely on large volumes of data, which may contain personal details that must be kept private.

- **describe considerations for inclusiveness in an AI solution and describe considerations for transparency in an AI solution**

  AI systems should empower everyone and engage people. AI should bring benefits to all parts of society, regardless of physical ability, gender, sexual orientation, ethnicity, or other factors.

  AI systems should be understandable. Users should be made fully aware of the purpose of the system, how it works, and what limitations may be expected.

- **describe considerations for accountability in an AI solution**

  People should be accountable for AI systems. Designers and developers of AI-based solutions should work within a framework of governance and organizational principles that ensure the solution meets ethical and legal standards that are clearly defined.

Describe fundamental principles of machine learning on Azure (25— 30%)

Identify common machine learning types

The supervised machine learning approach requires you to start with a dataset *with* known label values. Two types of supervised machine learning tasks include regression and classification. To make a prediction.

The unsupervised machine learning approach starts with a dataset *without* known label values. One type of unsupervised machine learning task is clustering. To recognize structure or pattern.

- **identify regression machine learning scenarios**

  Regression predicts a numeric *label* or outcome based on variables or *features*. For example, an automobile sales company might use the characteristics of a car (such as engine size, number of seats, mileage, and so on) to predict its likely selling price. In this case, the characteristics of the car are the features, and the selling price is the label.

  Regression is an example of a *supervised* machine learning technique in which you train a model using data that includes both the features and known values for the label so that the model learns to *fit* the feature combinations to the label. Then, after training has been completed, you can use the trained model to predict labels for new items for which the label is unknown.

  Regression machine learning models are used in many industries. A few scenarios are:

- Using characteristics of houses, such as square footage and the number of rooms, to predict home prices.
- Using characteristics of farm conditions, such as weather and soil quality, to predict crop yield.
- Using characteristics of a past campaign, such as advertising logs, to predict future advertisement clicks.

Designer's Score Model component to generate the predicted class label value.

- **identify classification machine learning scenarios**

  Classification is a form of machine learning that is used to predict which category, or *class*, an item belongs to. This machine-learning technique can be applied to binary and multi-class scenarios. For example, a health clinic might use the characteristics of a patient (such as age, weight, blood pressure, and so on) to predict whether the patient is at risk of diabetes. In this case, the characteristics of the patient are the *features*, and the *label* is a binary classification of either 0 or 1, representing non-diabetic or diabetic.

  Classification machine learning models are used in many industries. A few scenarios are:

  - Using clinical data to predict whether a patient will become sick or not.

- Using historical data to predict whether text sentiment is positive, negative, or neutral.
- Using characteristics of small businesses to predict if a new venture will succeed.

Designer's Score Model component to generate the predicted class label value.

- **identify clustering machine learning scenarios**

  Clustering is a form of machine learning that is used to group similar items into clusters based on their features. For example, a researcher might take measurements of penguins, and group them based on similarities in their proportions.

  Clustering machine learning models are used in many industries. A few scenarios:

  - Cluster customer attribute data into segments for marketing analysis.
  - Cluster geographic coordinates into regions of high traffic in a city for a ride-share application.
  - Cluster written feedback into topics to prioritize customer service changes.

  Designer's Assign Data to Clusters component to group the data into clusters.

Describe core machine learning concepts

• identify features and labels in a dataset for machine learning

Data Labelling is identifying raw data and adding one or more meaningful and informative labels to provide context.

With **Supervised ML** each piece of data will be labeled by a human.

With **Unsupervised ML** labels will be produced by machines not human readable.

Features are numerical values. ML models only work with numerical data.

• describe how training and validation datasets are used in machine learning

- Prepare data: Identify the features and labels in a dataset. Pre-process, or clean and transform, the data as needed.
- Train model: Split the data into two groups, a training, and a validation set. Train a machine learning model using the training data set. Test the machine learning model for performance using the validation data set.
- Evaluate performance: Compare how close the model's predictions are to the known labels.

- Deploy a predictive service: After you train a machine learning model, you can deploy the model as an application on a server or device so that others can use it.

Describe capabilities of visual tools in Azure Machine Learning Studio

Azure Machine Learning Studio is a web portal for machine learning solutions in Azure. It includes a wide range of features and capabilities that help data scientists prepare data, train models, publish predictive services, and monitor their usage.

- **automated machine learning**

Automated machine learning allows you to train models without extensive data science or programming knowledge. For people with a data science and programming background, it provides a way to save time and resources by automating algorithm selection and hyperparameter tuning.

- **Azure Machine Learning designer**

In Azure Machine Learning studio, there are several ways to author regression machine learning models. One way is to use a visual interface called *designer* that you can use to train, test, and deploy machine learning models. The drag-and-drop interface makes use of clearly defined inputs and outputs that can be shared, reused, and version controlled.

Each *designer* project, known as a pipeline, has a left panel for navigation and a canvas on your right-hand side. To use *designer*, identify the building blocks, or components, needed for your model, place and connect them on your canvas, and run a machine learning job.

Describe features of computer vision workloads on Azure (15—20%)

Identify common types of computer vision solutions

The Computer Vision service is a cognitive service in Microsoft Azure that provides pre-built computer vision capabilities. The service can analyze images, and return detailed information about an image and the objects it depicts.

- A **key** that is used to authenticate client applications.
- An **endpoint** that provides the HTTP address at which your resource can be accessed.

- **identify features of image classification solutions**

Computer Vision has the ability to analyze an image, evaluate the objects that are detected, and generate a human-readable phrase or sentence that can describe what was detected in the image.

You can use a machine learning *classification* technique to predict which category, or *class*, something belongs to. Classification machine learning models use a set of inputs, which we call *features*, to calculate a probability score for each possible class and predict a *label* that indicates the most likely class that an object belongs to.

To train a classification model, you must upload images to your training resource and label them with the appropriate class labels. Then, you must train the model and evaluate the training results. (Custom Vision portal)

- **identify features of object detection solutions**

Object detection model returns the following information:

- The *class* of each object identified in the image.
- The probability score of the object classification
- The coordinates of a *bounding box* for each object.

The object detection capability is similar to tagging, in that the service can identify common objects; but rather than tagging, or providing tags for the recognized objects only, this service can also return what is known as bounding box coordinates. Not only will you get the type of object, but you will also receive a set of coordinates that indicate the top, left, width, and height of the object

detected, which you can use to identify the location of the object in the image.

- **identify features of optical character recognition solutions**

The Computer Vision service can use optical character recognition (OCR) capabilities to detect printed and handwritten text in images.

- note taking
- digitizing forms, such as medical records or historical documents
- scanning printed or handwritten checks for bank deposits

The Read API uses the latest recognition models and is optimized for images that have a significant amount of text or have considerable visual noise.

The results from the Read API are arranged into the following hierarchy:

1. Pages
2. Lines
3. Words

- **identify features of facial detection, facial recognition, and facial analysis solutions**

The Computer Vision service can detect and analyze human faces in an image, including the ability to determine age and a bounding box rectangle for the location of the face(s).

Identify Azure tools and services for computer vision tasks

- **identify capabilities of the Computer Vision service**

Computer Vision: A specific resource for the Computer Vision service. Use this resource type if you don't intend to use any other cognitive services, or if you want to track utilization and costs for your Computer Vision resource separately.

- **identify capabilities of the Custom Vision service**

Azure Custom Vision is an image recognition service that lets you build, deploy, and improve your own image identifier models. An image identifier applies labels to images, according to their visual characteristics. Each label represents a classification or object. Unlike the Computer Vision service, Custom Vision allows you to specify your own labels and train custom models to detect them.

- **identify capabilities of the Face service**

The Azure Face service provides AI algorithms that detect, recognize, and analyze human faces in images.

Facial recognition software is important in many different scenarios, such as identity verification, touchless access control, and face blurring for privacy.

- **identify capabilities of the Form Recognizer service**

Azure Form Recognizer is a cloud-based Azure Applied AI Service for developers to build intelligent document processing solutions. Form Recognizer applies machine-learning-based optical character recognition (OCR) and document understanding technologies to classify documents, and extract text, tables, structure, and key-value pairs from documents.

- The name, address, and telephone number of the merchant.
- The date and time of the purchase.
- The quantity and price of each item purchased.
- The subtotal, tax, and total amounts.

The pre-built receipt model is designed to recognize common receipts, in English, that are common to the USA. (maximum file size of JPG is 50 MB)

Describe features of Natural Language Processing (NLP) workloads on Azure (25—30%)

Identify features of common NLP Workload Scenarios

- **identify features and uses for key phrase extraction**

Key phrase extraction is the concept of evaluating the text of a document, or documents, and then identifying the main talking points of the document(s).

- **identify features and uses for entity recognition**

You can provide the Language service with unstructured text and it will return a list of *entities* in the text that it recognizes. The service can also provide links to more information about that entity on the web.

- **identify features and uses for sentiment analysis**

The text analytics capabilities in the Language service can evaluate text and return sentiment scores and labels for each sentence. This capability is useful for detecting positive and negative sentiment in social media, customer reviews, discussion forums and more.

Using the pre-built machine learning classification model, the service evaluates the text and returns a sentiment score in the range of 0 to 1, with values closer to 1 being a positive sentiment. Scores that are close to the middle of the range (0.5) are considered neutral or indeterminate.

- **identify features and uses for language modeling**

A *language* model that maps phonemes to words, usually using a statistical algorithm that predicts the most probable sequence of words based on the phonemes.

- **identify features and uses for speech recognition and synthesis**
    - Speech recognition involves taking the spoken word and converting it into data that can be processed - often by transcribing it into a text representation. The spoken words can be in the form of a recorded voice in an audio file, or live audio from a microphone. Speech patterns are analyzed in the audio to determine recognizable patterns that are mapped to words.
    - Speech synthesis is in many respects the reverse of speech recognition. It is concerned with vocalizing data, usually by converting text to speech. A speech synthesis solution typically requires the following information:
        - The text to be spoken.
        - The voice to be used to vocalize the speech.

- **identify features and uses for translation**
    - A literal translation is where each word is translated to the corresponding word in the target language. This approach presents some issues. In one case, the target language may not have an equivalent word. Another case is where literal translation can change the phrase's meaning or not get the context correct.

- *Text translation* can be used to translate documents from one language to another, translate email communications that come from foreign governments, and even provide the ability to translate web pages on the Internet. Many times you will see a *Translate* option for posts on social media sites, or the Bing search engine can offer to translate entire web pages that are returned in search results.

Identify Azure tools and services for NLP workloads

- **identify capabilities of the Language service**
  - Use the language detection capability of the Language service to identify the language in which text is written.
  - There may be text that is ambiguous in nature, or that has mixed language content. The results in a value of unknown for the language name and the language identifier, and a score of NaN.

- **identify capabilities of the Speech service**
  - You can use the speech-to-text API to perform real-time or batch transcription of audio into a text format. The audio source for transcription can be a real-time audio stream from a microphone or an audio file.
  - Real-time speech-to-text allows you to transcribe the text in audio streams. You can use real-time transcription for presentations, demos, or any other scenario where a person is speaking.

    - The text-to-speech API enables you to convert text input to audible speech, which can either be played directly through a computer speaker or written to an audio file.
    - When you use the text-to-speech API, you can specify the voice to be used to vocalize the text. This capability offers you the flexibility to personalize your speech synthesis solution and give it a specific character.

- **identify capabilities of the Translator service**
    - The Translator service is easy to integrate into your applications, websites, tools, and solutions. The service uses a Neural Machine Translation (NMT) model for translation, which analyzes the semantic context of the text and renders a more accurate and complete translation as a result.
    - The Translator service supports text-to-text translation between more than 60 languages. When using the service, you must specify the language you are translating *from* and the language you are translating *to* using ISO 639-1 language codes, such as *en* for English, *fr* for French, and *zh* for Chinese.
    - **Profanity filtering**. Without any configuration, the service will translate the input text, without filtering out profanity. Profanity levels are typically culture-specific but you can control profanity translation by either marking the translated text as profane or by omitting it in the results.
    - **Selective translation.** You can tag content so that it isn't translated. For example, you may want to tag code, a brand name, or a word/phrase that doesn't make sense when localized.

- The Speech service includes the following application programming interfaces (APIs):
  - Speech-to-text - used to transcribe speech from an audio source to text format.
  - Text-to-speech - used to generate spoken audio from a text source.
  - Speech Translation - used to translate speech in one language to text or speech in another.

Identify considerations for conversational AI solutions on Azure

Creating Language Model

- An utterance is an example of something a user might say, and which your application must interpret.
- An entity is an item to which an utterance refers.
- An intent represents the purpose, or goal, expressed in a user's utterance.
- The None intent is considered a fallback and is typically used to provide a generic response to users when their requests don't match any other intent.

Creating an application with Conversational Language Understanding consists of two main tasks. First, you must define entities, intents, and utterances with which to train the language model - referred to as *authoring* the model. Then you must publish the model so that client applications can use it for intent and entity *prediction* based on user input.

- **identify features and uses for bots**

  Organizations are turning to artificial intelligence (AI) solutions that make use of AI agents, commonly known as *bots* to provide a first-line of automated support through the full range of channels that we use to communicate. Bots are designed to interact with users in a conversational manner.

- **identify capabilities of the Azure Bot service**
    - Extend the bot's functionality by adding custom code.
    - Test the bot in an interactive test interface.
    - Configure logging, analytics, and integration with other services.

  When your bot is ready to be delivered to users, you can connect it to multiple *channels*; making it possible for users to interact with it through web chat, email, Microsoft Teams, and other common communication media.

  Users can submit questions to the bot through any of its channels, and receive an appropriate answer from the knowledge base on which the bot is based.L