(2½ Hours)

[Total Marks: 60]

N. B.: (1) **All** questions are **compulsory**.
(2) Make **suitable assumptions** wherever necessary and **state the assumptions** made.
(3) Answers to the **same question** must be **written together**.
(4) Numbers to the **right** indicate **marks**.
(5) Draw **neat labelled diagrams** wherever **necessary**.
(6) Use of **Non-programmable** calculators is **allowed**.

I	**Choose the correct alternative and rewrite the entire sentence with the correct alternative.** **(30)**			
1.	Which one of the following is Cloud Platform by Amazon?			
	a.	Azure	**b.**	AWS
	c.	Cloudera	**d.**	Cloud
Answer: b				
2.	Which instruction set architecture is used in Raspberry Pi?			
	a.	X86	**b.**	ARM
	c.	MSP	**d.**	AVR
Answer: b				
3.	MQTT is mainly used for _____			
	a.	M2M communication	**b.**	Device communication
	c.	Internet communication	**d.**	Wireless communication
Answer: a				
4.	Which of the following is not the way power can be supplied to RPi?			
	a.	USB connection	**b.**	Internal battery
	c.	Charger	**d.**	Adapter
Answer: b				
5.	AMQP stands for _____			
	a.	Advanced Message Queuing Protocol	**b.**	Application Message Queuing Protocol
	c.	Application Mailing Queuing Protocol	**d.**	Advanced Mailing Queuing Protocol
Answer: a				
6.	XMPP Full form is _____			

	a.	Extensible Messaging and Presence Protocol	**b.**	Extensible Module and presence protocol
	c.	Extensible Module and presence protocol	**d.**	Extensible Messaging and Presence Protocol
Answer: a				
7.	All the APIs released by Microsoft can be categorized into one of _____ groups.			
	a.	Four	**b.**	Ten
	c.	Two	**d.**	Three
Answer:a				
8.	_____ is the process of representing information and using that representation to reason observation enables machines to mimic human behavior.			
	a.	Identification	**b.**	Interaction
	c.	Cognition	**d.**	Storage
Answer : c				
9.	_____ is the process of improving automatically over time.			
	a.	Identification	**b.**	Active learning
	c.	Interaction	**d.**	Storage
Answer : b				
10.	The Microsoft Cognitive API is easy to consume. You just need to get the _____ for your respective API.			
	a.	primary key	**b.**	secondary key
	c.	subscription key	**d.**	unique key
Answer : c				
11.	The entire Microsoft cognitive documentation is being hosted on _____ and individual developers can contribute to making it more effective.			
	a.	Google	**b.**	GeekforGeek
	c.	TutorialPoint	**d.**	GitHub
Answer : d				
12.	Almost all _____ have a free and paid tier.			
	a.	Cognitive APIs	**b.**	Login APIs
	c.	Secrete APIs	**d.**	Azure APIs
Answer : a				
13.	You can use the free API keys with a Microsoft account.			
	a.	Organization account	**b.**	Orkut account
	c.	Microsoft account	**d.**	Gmail account
Answer: c				
14.	If the system is pre-trained with the faces of a specific person, it can _____ that person's face in a photo.			
	a.	lock	**b.**	match and recognize

	c.	avoid	**d.**	detect
Answer: b				
15.	Uber, one of the largest taxi service companies, is using _____ to verify Uber drivers.			
	a.	voice recognition	**b.**	thumb impression
	c.	face verification	**d.**	Aadhar card
Answer : c				
16.	Humans interact with each other and now with machines in one of three ways—verbally, using written language, and using _____.			
	a.	Voice	**b.**	Face expression
	c.	Gestures	**d.**	Button inputs
Answer : c				
17.	LUIS stand for _____.			
	a.	Lateral Understanding Intelligent ServiceLanguage	**b.**	Uniform Intelligent Service Language
	c.	Language Understanding Intelligent Service	**d.**	Understanding Intelligent System
Answer : c				
18.	_____helps resolve some areas of unstructured data by detecting sentiments (positive or negative), key phrases, topics, and language from your text.			
	a.	Text Analytics	**b.**	Speech Analytics
	c.	Object Analytics	**d.**	Structure Analytics
Answer : a				
19.	_____ allows you to retrieve information from Microsoft Academic Graph, a proprietary knowledgebase of scientific/scholarly research papers and their entities			
	a.	Academic Knowledge API	**b.**	Research API
	c.	Scientific API	**d.**	Graph API
Answer: a				
20.	_____ creates FAQ-style questions and answers from the provided data.			
	a.	Test Maker	**b.**	Code Maker
	c.	QnA Maker	**d.**	FAQ Maker
Answer: c				
21.	You can't use the same _____ to call two different cognitive services.			
	a.	Subscription key	**b.**	primary key
	c.	secondary key	**d.**	Logic key
Answer : a				
22.	The domain of interpreting human languages is called _____.			
	a.	Neutral Language Understanding	**b.**	Natural Lateral Understanding
	c.	Natural Language Uniform	**d.**	Natural Language Understanding
Answer : d				
23.	NLU is the ability of a _____ to convert natural language text to a form that the computer can understand.			
	a.	Human	**b.**	Machine
	c.	Object	**d.**	Data
Answer : b				

24.	If you want to deal with multiple similar _____, there's a good chance LUIS will get confused with the lack of sufficient training.			
	a.	use cases	**b.**	use test
	c.	test cases	**d.**	training cases
Answer : a				
25.	The _____ is more like a bible of metadata that stores utterances, along with its associated intents and entities. You can use it as a design document for your NLU.			
	a.	DBMS	**b.**	Database
	c.	data dictionary	**d.**	Tables
Answer : c				
26.	A message broker is responsible for: i) to receive all the messages from all the clients ii) to maintain client session details iii) database of stored messages			
	a.	i & ii	**b.**	ii & iii
	c.	ii & iii	**d.**	i & ii
Answer : d				
27.	When there is a broken connection, one of the two parties may not know that the connection is broken. This situation is called a _____ .			
	a.	keep alive	**b.**	half-open connection
	c.	broken connection	**d.**	one way connection
Answer : b				
28.	A_____ is essentially an arrangement where a certain program or function listens to the live message stream and stores everything it listens to in the database.			
	a.	database converter	**b.**	database listener
	c.	database listing	**d.**	debug listener
Answer : b				
29.	The simple command-line tool, which is helpful in ensuring that a Node.js-based application runs continuously			
	a.	java utility	**b.**	server utility
	c.	node.js utility	**d.**	forever utility
Answer: d				
30.	_____is a human-readable data serialization language.			
	a.	Python	**b.**	DHTML
	c.	HTML	**d.**	YAML
Answer : d				

II	**Attempt *<u>any one</u>* of the following:**	
	a	Explain the concept of AI 2.0 in terms of IoT and other emerging technologies? Ans: 1. The next generation of AI technologies will take software solutions several steps ahead.AI 2.0 is something bigger than AI alone. It's no longer about just creating intelligent software. 2. This has been made possible by recent advancements in cognitive technologies (AI), the Internet of Things (IoT), and Blockchain. IoT and Blockchain are relatively recent developments but have co-existed with AI for some time now.

3. Improvements in AI technologies have made it increasingly easier to develop "complete" product offerings using AI, IoT, and Blockchain. To reiterate, it's not about just software anymore but it's about software and hardware on top of a highly secure and flexible network.
4. Smart Lean Manufacturing

- Manufacturing practices have become highly optimized. But there is still room for improvement. IoT devices can be used to monitor machines and environment. Intelligent analytics can then be performed over the collected monitoring data to generate insights to help further optimize manufacturing processes.
- Blockchain can help in securely and reliably distribute optimized parameters across a string of connected manufacturing plants.
- Supply chain can also be effectively managed using Blockchain.

5. Connected Homes

- Mark Zuckerberg, founder and CEO of Facebook, conducted and published a famous AI experiment in 2016. Jarvis was a custom home automation solution built using several open source and in-house AI libraries.
- AI 2.0 will allow us to easily create not just one such smart home but an ultra-secure network of connected smart homes.

6. Azure Cognitive Services

- Cognitive Services is a set of software-as-a-service (SaaS) commercial offerings from Microsoft related to artificial intelligence.
- Cognitive Services is the product of Microsoft's years of research into cognitive computing and artificial intelligence, and many of these services are being used by some of Microsoft's own popular products, such as Bing (search, maps), Translator, Bot Framework, etc.

b Describe the features and functions for designing IoT platform?
Ans:
Building your own IoT platform makes much more sense.
For any middleware platform to be worthy of being part of the Internet of Things, it is imperative that it has the following functionalities and capabilities.

1. Scalability. Just like any new application or product, things start small and then grow later. Therefore, if the middleware platform must be at the core of the solution, it must be able to scale in the same proportion. For example, if the IoT platform is for medical devices, financial services, or security systems, the level of reliability expected is relatively high when compared to one for home appliances like coffee machine or similar others.
2. Customization. Since we are building our own platform, it can be 100% customized; however, even if you were looking to buy off the shelf, customization without breaking the bank should be possible. If you cannot

customize the middleware, then you have to modify your product or service to be fit for the platform, which is essentially working in the reverse direction.

3. Supported protocols and interfaces. By fundamental definition, an IoT middleware platform sits between two heterogeneous systems: physical devices and cloud software (and there are umpteen numbers of device types and software). The platform should be able to coordinate with all of them, orchestrate things in unison, and speak all of the languages or protocols.
4. Cloud agnostic. Similar to being hardware agnostic, the platform also needs to be cloud agnostic. There are several cloud service providers—including Google, Microsoft, and Amazon Web Services (AWS)—but the platform should have no dependency on the cloud. Whether its your own service or a third-party cloud running behind a NAS (network-attached storage), the platform should be able to work.
5. Architecture and technology stack. A well-defined architecture and the appropriate combination of the technology stack is a key thing that differentiates a good IoT platform from the others. The platform may be built on a rather weird combination of technologies that are not known for working together nicely.
6. Security. Over the last several years, the Internet of Things has become a laughing stock, mainly due to poorly managed security aspects in far too many applications and IoT solutions. The saying, "The S in IoT stands for security," has become commonplace and is a strong indication that security in a middleware platform is as important as it is in other aspects of the IoT ecosystem. Security becomes a vital consideration factor if you choose a multitenant platform.
7. Cost. The budget set for an IoT platform has a relatively larger influence on cost factors; however, overall, if the cost of the platform (whether it was built in-house or bought off the shelf) does not justify the functionality and features, then it must be reviewed. In short, the platform should add enough value to justify its cost.

c What is Azure IoT suite? Which services are included in Azure IoT suite?
Ans:

- IoT suite is a collection of services, from Microsoft, to manage small to large networks of IoT devices. The services are especially useful in large setups, where managing hundreds or thousands or even millions of IoT devices manually just isn't possible.
- A typical setup, aka IoT solution, is composed of two major components: IoT devices and a solution backend. The Cloud-based solution backend is where data collected by devices is stored and analyzed. Azure IoT Suite provides end-to-end implementations for pre-configured or custom IoT solutions, such as

		remote monitoring (monitoring status of devices), • The suite usually goes with the following five Azure services: • IoT Hub—Enables secure, bi-directional communication between IoT devices and solution backend. Azure IoT device SDKs for various languages and platforms are provided to enable devices to reliably connect with their solution backend. IoT Hub provides solutions for problems such as device identity management, device twins, per-device authentication, routing device-to-Cloud messages to Azure services, etc. • Machine learning—A fully-managed Cloud service that enables you to easily build, deploy, and share predictive analytics solutions. Machine Learning Studio is a browser-based, drag-and-drop authoring environment that allows you to create ML models for your analytics needs. It comes with support for R and Python, languages commonly used for creating statistical, predictive solutions. ML Studio also provides a fully managed service you can use to deploy your predictive models as ready-to-consume web services. • Stream analytics—Develop and run real-time analytics on data streams captured by IoT devices. Analytics programs are written in an SQL-like declarative language, with support for JavaScript user-defined functions for temporal logic. Parallel real-time analytics on multiple IoT streams is supported. It is also possible to call Azure Machine Learning models for predictive scoring on streaming data. • Notification hubs—A mobile push notification engine to send out notifications at scale about various IoT events. It's a common requirement to receive notifications on mobile about job completion, regular monitoring updates, impending device failure, etc. • Notification hubs can send out notifications to millions of mobiles at once. All popular mobile platforms are supported, including Android, iOS, and Windows. • Power BI—A suite of business analytics and intelligence tools to create dashboards and charts using the results of analytics performed on data collected by IoT devices. Integrates well with stream analytics to create dashboards with real-time insights.
2	**Attempt *<u>any one</u>* of the following:**	
	a	What is the cognitive system? How it differs from traditional computing system? Ans: • Cognition is the process of representing information and using that representation to reason. Observation enables machines to mimic human behavior. For example, interacting with speech, text, or vision the way humans do. Active learning is the process of improving automatically over time.

- A classic example of Active Learning is Microsoft Language Understanding Intelligent Service (LUIS), Physical action requires using a combination of these three and devices to interact intelligently.

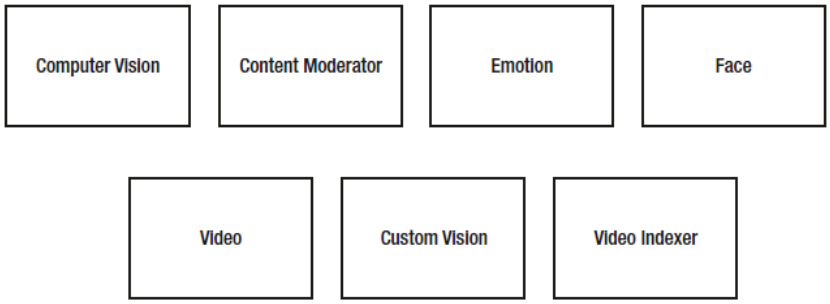
cognitive systems differ in three ways:

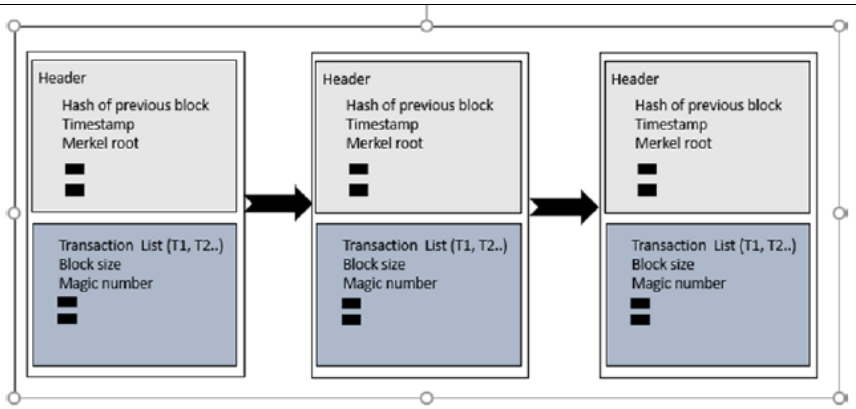
- Cognitive systems understand like humans do. We have seen the era where AI led machines are defeating some of the champions of the game. Libratus, designed by a team from Carnegie-Mellon, has defeated several Poker champions. Poker, as you may know, requires information to be hidden until a point in time and it is very difficult to create a model to handle such a situation.
- Cognitive systems have a unique ability to understand ideas and concepts, form a proposition, disambiguate, infer, and generate insights, based on which they can reason and act. For example, you can create a cognitive web application that can recognize human beings by looking at their images and then conversing with them in slang.
- Unlike traditional computing programs, cognitive systems are always learning based on new data. In fact, each cognitive system gets cleverer day by day based on learning new information. Over a period, proficiency moves from novice to expert.

b Explain the advantages of cognitive API?

Ans:

1. Built by Experts and Supported by Community: The Microsoft Cognitive API is a result of years of research done at Microsoft. This includes experts from various fields and teams like Microsoft research, Azure machine learning, and Bing, to name a few. Microsoft certainly did a great job of abstracting all the nuances of the deep neural network, which are complex algorithms that exposing easy-to-use REST APIs. This means that whenever you consume the Microsoft Cognitive API, you are getting the best functionality exposed in a RESTful manner.
2. Ease to Use : The Microsoft Cognitive API is easy to consume. You just need to get the subscription key for your respective API and then you can consume the APIs by passing this subscription key. The functionality is accomplished in a few lines of code. We will go into more detail about the subscription key later. For now, just understand that before you can start using Cognitive Services, you need a subscription key for each service you want to use in your application. Almost all Cognitive APIs have a free and paid tier.
3. Language and Platform Independent: Microsoft has started supporting open source in a better and more seamless way. Previously, Microsoft functionality was limited through the use of Microsoft-specific tools and languages like VB.NET, C#, etc.

	c	Explain the Microsoft computer vision API? Ans:  • Explanation for all subcategories expected for fair evaluation.
3	**Attempt *any one* of the following:**	
	a	Explain the block structure in Blockchain? Ans: • A block is a unit containing a set of confirmed transactions. If Blockchain is a ledger, think of a block as a page or book. Each block, as shown in Figure, is composed of the header, which contains information like the previous block hash reference, the timestamp on which block is generated, and so on, along with the body. The body of the block contains a list of the accepted transaction. The header is hashed cryptographically to generate a new block. • Every transaction is encrypted (hashed) with a public-private key and every header is hashed to generate a new block. Due to this implementation, every transaction has a record associated with the new block. The header also contains the address of the previous block, thus the chain becomes incorruptible. As more and more transactions happen, the Blockchain transaction appends only and creates a chronologically growing timestamp database of transactional data, as shown in Figure 7-14. It thereby creates a chain block, hence the name Blockchain.



b Write a note on benefits of Blockchain?

Ans:

Blockchain brings numerous benefits by storing and organizing the data in a novice way. Various industry verticals have been researching and exploring unique ways to use Blockchain in an effective manner. As mentioned earlier in the chapter, Blockchain can organize data for anything that has value. You can also use Blockchain in all the scenarios where it requires you to trust someone.

Here are some of the benefits of using Blockchain:

• Improves the efficiency of the system.
• All the changes on the public Blockchain can be viewed publicly by all parties, thereby creating transparent systems.
• Ensures transactions are immutable in nature, which means transactions cannot be altered or deleted. In order to modify existing transactions, the new transaction needs to be proposed.
• Blockchain transaction is processed 24/7 and can also help reduce transaction time to minutes.
• Provides a secured way to avoid cybersecurity and fraud risk by using trust secured algorithms.
• By eliminating third-party intermediaries and overhead cost, Blockchain has great potential to reduce transaction feeds.
• Provides alternate options of trust using centralized systems.
• Provides ways for identification and verification.

c What is testing with a Pass-Through Query in Azure?

Once the data is sampled and ready to be queried, you may stop the simulated device to prevent your IoT Hub from being metered further. Now, modify the query in the editor to update YourInputAlias to the name of your hub input. You may leave YourOutputAlias as is.

```
 SELECT *
INTO [YourOutputAlias]
 FROM [your-iothub-input-alias]
SELECT * FROM
```

picks up and displays all rows and columns from the specified table. In the context of Stream Analytics, this is what is called a "pass-through" query.
It selects all data from the given input and sends it to the given output. Ideally, you'd specify constraints and filters (e.g., the WHERE clause) to perform analysis and send only those records to an output that match your criteria. Click the Test button.
In the absence of a permanent storage output, the pass-through query generates results in a browser .
You can match column names in the SA query result with the attribute names in the sample message.

4 **Attempt *<u>any one</u>* of the following:**

a What is node-RED? Explain in brief.
Ans:

b Explain the installation of node.js in detail?
Ans:
Node.js is a server-side implementation of JavaScript. It provides ultra-fast APIs for accessing I/O (files, databases, etc.) and other system-level resources. In other words, Node is an application server to run JavaScript-based applications. Learn more about Node at https://nodejs.org.
There is more than one way to install the latest version of node.js in Raspbian. It's best to follow the official installation instructions as mentioned at https://nodejs.org. Since Raspbian is a Debian-based Linux OS, follow the instructions to install node via
package manager (apt-get). The following two commands should ideally do the trick:
curl -sL https://deb.nodesource.com/setup_9.x | sudo -E bash -
sudo apt-get install -y nodejs
To verify if node was installed correctly, run this command:
node –v
wget https://nodejs.org/dist/v9.5.0/node-v9.5.0-linux-armv6l.tar.xz
Next, extract the downloaded tarball archive to a globally-accessible location. Run the following three commands:
sudo mkdir /usr/lib/nodejs
sudo tar -xJvf node-v9.5.0-linux-armv6l.tar.xz -C /usr/lib/nodejs
sudo mv /usr/lib/nodejs/node-v9.5.0-linux-armv6l /usr/lib/nodejs/node-v9.5.0
Add the above directory permanently to your PATH environment variable.
Open the .profile file in a text editor:
nano ~/.profile
And add these lines to the end of the document:
export NODEJS_HOME=/usr/lib/nodejs/node-v9.5.0
export PATH=$NODEJS_HOME/bin:$PATH
Finally, refresh your PATH:

		. ~/.profile
	c	What is message broker? Explain MQTT.
5		**Attempt *any one* of the following:**
	a	Explain CoSIP protocol to develop smart applications? Ans: The CoSIP protocol provides an alternative mechanism to register resources on an RD, which may also be called a CoSIP registrar server. The advantage of using a CoSIP-based registration mechanism is that it might be possible to register resources other than those reachable through CoAP, thus providing a scalable and generic mechanism for service discovery in constrained applications with a higher degree of expressiveness, such as setting an expiration time for the registration. In both constrained and non-constrained environments, there are many applications in which it may either be necessary or simply advantageous to negotiate an end-to-end data session. In this case the communication model consists of a first phase in which one endpoint requests the establishment of a data communication and, optionally, both endpoints negotiate communication parameters (transfer protocols, data formats, endpoint IP addresses and ports, encryption algorithms and keying materials, and other application specific parameters) of the subsequent data sessions. This may be useful for both client-server and peer-to-peer applications, regardless of whether the data sessions evolve according to a request/response model.
	b	Explain how smart objects depend upon REST integration in brief? Ans: Smart objects are typically required to operate using low-power and low-rate communication methods, featuring unstable (lossy) links, such as IEEE 802.15.4. These are usually termed low-power wireless personal area networks (LoWPANs) or low-power and lossy networks (LLNs). The Internet Engineering Task Force (IETF) has set up several working groups in order to address issues related to bringing IP connectivity to LoWPAN smart objects. In particular, the 6LoWPAN (IPv6 over Low-power WPAN) working group [19] was chartered to define mechanisms to optimize the adoption of IPv6 in LoWPANs and the ROLL (Routing over Low-power and Lossy Networks) working group [20] was formed to develop optimal IPv6 routing in LLNs. Finally, the CoRE (Constrained RESTful Environments) working group [21] was chartered to provide a framework for RESTful applications in constrained IP networks. It is working on

		the definition of a standard application-level protocol, namely CoAP, which can be used to let constrained devices communicate with any node, either on the same network or on the Internet, and provides a mapping to HTTP REST APIs. CoAP is intended to provide, among others, create-read-update-delete (CRUD) primitives for resources of constrained devices and pub/sub communication capabilities. While the work on CoAP is already at an advanced stage, the CoRE working group is also investigating mechanisms for discovery and configuration, but work on these issues is still at an early stage and therefore open to proposals
	c	Explain Industrial IoT applications? Ans: IIoT still lacks a reference networking/communication platform. Several initiatives are being developed: in the following, we comment on a few relevant ones. The German Plattform Industrie 4.0 is a candidate to become a European standard platform. This process is taking place within EU institutions, and individual European countries have their own industrial transformation projects in which the IIoT takes center stage, including: • Smart Factory (The Netherlands) • Factory 4.0 (Italy) • Industry of the Future (France). Other major efforts include the Japanese Robot Revolution initiative and the Industrial Internet Consortium (IIC). The latter is a consortium co-founded by US industrial giant GE, which also coined the term Industrial Internet and is one of the major players in the IIoT. The IIC today is busy mainly with the promotion of the IIoT, in which data is used in order to improve operations, enhance service and detect new opportunities. The IIC collaborates with the Industry 4.0 Platform. Just like the Industry 4.0 Platform, the Internet of Things Consortium has developed a framework called the Industrial Internet Reference Architecture (IIRA). The first version was released in 2015 and version 1.8 of the IIRA was published in January 2017. It aims to help all sorts of experts who are involved in IIoT projects to consistently design IIoT solution architectures and deploy interoperable IIoT systems. On top of the IIRA model, in February 2017 the IIC also published the Industrial Internet Connectivity Framework (IICF).