





(Section B)

Q. No. 2 Part (i)

Machine Learning:

There are many advantages of machine learning. Some of them are:

(1) Easily Process Large Amount of Data:

Machine learning models can easily process large amounts of data without human intervention.

(2) Make Accurate Predictions:

Once the model is trained by providing data it can make accurate and better predictions.

(3) Improves Overtime:

Machine learning model constantly improves overtime is flexible enough to understant new data and identify patterns

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Q. No. 2 Part (ii)

Stack	Queue
(1) Stacks are data storage structures which work on LIFO principle. (Last in First out).	Queues are data storing structures that work on FIFO principle (First In First out).
(2) Operators used are Pop, push, Top, Is Empty, Is Full	Operators used are Enqueue, Dequeue, Front, Is Empty, Is full.
(3) Example in real life is stacking bricks on top of each other and using the one on top and those beneath the top one.	Example in real life is waiting lines for ticket purchasing where the first person leaves the queue.

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Q. No. 2 Part (iii)

- **Linked List:**

Linked list are the elements in a list which are connected to each other. Each element consist of a node and referance to the next node. There are three types; singly linked list, doubly linked list and circular linked list.

Advantages:

(1) Linked list does not require fixed storage or elements.
(2) It is optimal for changing size and elements.
(3) A value can easily be found each node's is connected to each other.
(4) In circular linked list it allows traversal in both directions.

Q. No. 2 Part (iv)

- **P-value:**

P-value or probability value is essential in hypothesis testing as it indicates That wheather the result is by chance or any coincidence.

(1) Low p-values provide strong evidence against null hypothesis and explains that the relation is not by any chance.
(2) High p-value supports the null hypothesis (H_0) and indicates that the result is most likely due to coincidance.

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Q. No. 2 Part (v)

Symmetric Cryptography	Assymetric Cryptograp
(1) Consists of a single key ciphering and decyphering of plain and cyphered text (private key).	Consists of a pair of public and private k for cyphering and decyphering data.
(2) It is efficient and data transfers is rapid.	It is less efficient and takes more time
(3) Provides less security	Provides more seari
(4) Large amounts of data can be transfered.	less data is transf

Q. No. 2 Part (vi)

Time Complexity	Space Complexity
(1) It is an evaluation of efficiency by measuring time.	It is also an evaluation for efficiency by measuring the space.
(2) It refers to the total time required for an algorithm to run.	It refers to the total space an algorithm needs.
(3) For e.g: Time complexity of linear search is O(n).	For e.g: space complexity of linear search is O(1).

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Q. No. 2 Part (vii)

- **Two Factor Authentication (2FA):**

Two factor authentication means adding another layer for security purpose to protect sensitive and private information.

(1) It enhances privacy by adding another layer for private data to be safeguarded.

(2) It enhances security by adding an additional authentication layer for e.g.: sending code from phone or from apps. This increases security incase one method is attacked by cyber attacks.

Q. No. 2 Part (viii)

- **Queue Operators:**

The purpose of enqueue, dequeue, front operators is:

(1) **Enqueue:**
An element is added at the end of the queue.

(2) **Dequeue:**
Removes an element from the start of the queue.

(3) **Front:**
Returns the first or starting element of a queue.

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Q. No. 2 Part (ix)

- **Array:**

An array is a data storage structure that stores data that is fixed in size and elements through contiguous memory locations. These memory locations are called index.

- **Advantages:**

(1) It stores data of the same size and is efficient.

(2) It is optimal for cases where the size of the data is fixed and does not change.

(3) The elements can easily be identified by index.

The types are one dimentional and two dimentional arrays.

Q. No. 2 Part (x)

- **A/B testing:**

A/B testing means testing two versions of a system at a time to determine which has more usability and is efficient and user-friendly for the users.

- For example,

If two versions are made for home page of a website. The users are given different versions to test which version is easy to use and learn. This version is then selected.

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Q. No. 2 Part (xi)

- **Caesar Cypher:**

Caesar cypher encrypts the data or alphabets by a fixed number of shifts such that the cyphered data is unreadable even if unknown authorization gains the data.

For example:

With a shift a 3 a becomes d and b becomes e and t becomes x.

Plain word	Cypher word:
Bat	dex Edx

Q. No. 2 Part (xii)

- **Digital Tools:**

Digital tools help to transform complex data, provide context and makes it easier for users to understand it.

(1) For length text data we can use digital tools like Microsoft word or Google docs.

(2) For charts, graphs and flowcharts we can use Microsoft Powerpoint or google slidesho

(3) For expressing numerical data in large quantities we can use Microsoft Excel, or Google Spread Sheets.

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Q. No. 2 Part (xiii)

(1) **Mean:**

Mean value means the average of the values. It is sum of values divided by total number of values. The average of 2 and 4 is 3.

(2) **Median:**

Median is the middle value present inside a data set or or middle value of a set. (1,2,3,4,5) The median is 3

(3) **Mode:**

Mode is the most repeated value present in the data. (1,2,3,4,3,5) The mode is 3

Q. No. 2 Part (xiv)

- **IoT in controlling Air Pollution:**

As the population is increasing rapidly the vehicles are increasing in number That cause air-pollution. Iot can be helpfull in reducing air pollution.

(1) Place IoT bassed sensors in areas where the air is polluted. It recieves and sends information.

(2) The information is passed on to the cloud where analysis is done. The cloud can store data and even send alerts if air in a region is polluted.

(3) The data is sent for storage, transmission and processing to the blockchain to ensure security through cryptography.

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Q. No. 3 (Page 1)

- **Human Computer Interaction (HCI):**

Human computer interaction in context of computer science is a multi-dimentional field which studies the relation between the interaction of humans and computer or a system. The aim of HCI is to improve the interaction by providing efficient, user-friend and cost effective use. Although there are many advantages of this interaction, there are some problems that occur in human-computer interface.

- **Problems:**

The purpose of using HCI is to improve the relation b/w human and computer but there are some problems that may occur. Following are two of many problems that may occur:

(1) **Poor Error Messages:**

Problems may occur related to poor error messages. These messages may cause confusion and frustration for users. The system should provide proper error messages along side context so that users can understand their mistake and learn from it. Proper messages should

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be provided regarding an error.

For example:

A user operates the system and encounters error "1202". This error can cause confusion and frustration between the users. To avoid this confusion you should provide proper error context and what caused it. Like if the error says "Error 1202, verify your files" the user understands the files may be corrupt and he verifies it.

(2) Lack of Accessibility:

The purpose of this interaction (HCI) is to improve connectivity but lack of accessibility causes the people with particular disabilities to be left out and not engage with system. The purpose of HCI is to inclusive but lack of accessibility causes people with motor, sensory or hearing disabilities to not interact with the system.

For example:

A person with sensory impairment is trying to use the system to interact but he is unable to see the components due to sensory disability. There should be accessibilites introduced to facilitate these users like voice over compands, high contrast mode and zooming features.

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Q. No. 4 (Page 1)

- **Hypothesis:**

(1) Hypothesis is an educated guess which explains wheather there exists a relation between two values or unknowns.

(2) Hypothesis provides us a starting point with which we determine the relation if exists any.

(3) An example of hypothesis is:
"More study hours lead to increased exam score".

(4) This a hypothesis made in which we check exists a relation between two values.

- **Hypothesis Formation:**

There are several steps included in hypothesis formation. The steps are given below:

(1) Formulate a hypothesis between two unknown or two values.

(2) Develop null (H_0) and alternative (H_1) hypothesis.

(3) Analyze the hypothesis by performing an experiment.

(4) Match the values obtained with the critical values in order to accept or reject the null hypothesis.

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(5) After declaring the correct hypothesis check the p-values and significance threshold to check wheather the results are by any chance or coincidence.

(6) Formulate the result and make it a statemen alongside performed experiment.

(7) Declare this hypothesis world wide that a change in certain values affect the dependent value.

Types of Hypothesis:

There are types of hypothesis.

(1) Null hypothesis (H_0)

(2) Alternative hypothesis (H_1)

If the hypothesis is

"Intake of coffee increases cognitive level"

(1) Null Hypothesis (H_0):

Null hypothesis explains that there is no relation between two values. According to the hypothesis formulated it says that intake of coffee does not increase cognative level. If there is a relation it is most likely due to a chance of coincidence.

(2) Alternative Hypothesis (H_1):

Alternative hypothesis says that there is a

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relation between the two values. According to the formulated hypothesis, alternative hypothesis says that intake of coffee increases cognative level.

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Q. No. 5 (Page 1)

- **Internet of Things (IoT):**

Internet of things means our everyday physical objects or products that connected to each other over the internet and serves to send and recieve data or information.

We use various IoT devices in our daily life. These devices makes our lives easier by reducing the cost and maximizing efficiency. There are various IoT devices used in many fields. Some of these fields include healthcare and Traffic management.

(i) IoT devices in Healthcare:

Due to increase in population of Pakistan the number of healthcare cases are increasing day to day. The healthcare sector in Pakistan is pretty much optimized by the use of these of these IoT devices. IoT devices are helpfull in healthcare sector due to following reasons:

(1) IoT combined with AI causes the patheints record, medical reports to be stored so that they can easily be accessed later and immediately when required.

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(2) IoT devices combined with AI results in better treatment, future affects and ongoing medical assistance.

(3) IoT devices like sensors are used to detect human blood levels, sugar level, oxygen level and even pulse rate. This provides constant tracking of human health.

(4) Iot based beds in hospitals can track the patients movement and can alert the ward if there is an emergency.

(5) One new and important introduction of IoT is smart ambulance systems. These ambulances can perform minor treatment and can lead reduction in loss of life.

(2) Traffic Management System and IoT:

Due to increase in population of Pakistan the traffic is increasing significiantly. To optimize this traffic flow IoT is used in the following ways:

(1) IoT based sensors recieves and transfers information to the control rooms.

(2) IoT based cameras can be used to dectect any acidents.

(3) IoT tends to optimize the traffic flow by informing the control rooms regarding the traffic flow in an area.

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(4) IoT based smart cameras help to identify the person abrogating the traffic rules and causing traffic.

(5) IoT based devices can inform the indivisuals to avoid a certain path due to ongoing traffic flow.

(6) Iot based speed dectors detect the speed of indivisuals who are over speeding and send online E-challans.

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Q. No. 6 (Page 1)

- **Neural Network:**

A neural network is the simulation of human brain. It works as the neurons work in a human body. The network consists of neurons which recieves and sends information throughout the network just like a human brain.

A neural network makes predictions or solves a complex problem. This done by training of a neural network. The network is trainned by two process.

(i) Feedforward Propagation:

In feedforward propagation the traversal flows from left to right. It is driven from the input layer to the next hidden layer and finally to the output layer. Each neuron recieves an information or raw data regarding inputs and outputs. The output values using activation function decides wheather the information is passed on. If the output value reaches a certain threshold the information or data is passed from a neuron to the next layer or resulted as an output. If the output value is less than the threshold no information is passed. Neurons in an each

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layer carry a certain data that is either returned as output or not passed to the next Layer's neuron.

(a) Backward Propagation:

Backward propagation reduces the differences between the predicted value by the network with the actual or true value. The purpose of backward propagation is to check wheather the network is used solves a problem or not. It also evaluates the performance of the network by optimizing it by minimizing the loss. The loss refers to the errors or mistakes made within the network. The weights are associated with the output layer, then the hidden layer and finally the input layer. This backward propagation helps by increasing accuracy of the network as the network learns through it and also it minimizes the differences between actual and predicted value.

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