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Q. No. 2 Part (I) **Aspects of Usability:**

Given below are three aspects of usability in system design:

a) **Effectiveness:** It means how effective our solution is. This makes sure that user is getting their required outputs.

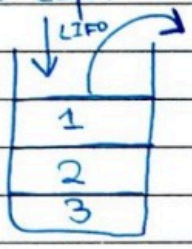
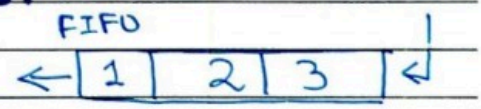
b) **Efficiency:** It means how efficient our solution is. It deals with time of output and how bulky in space it is.

c) **Satisfaction:** This means the degree of satisfaction user has with using our system.

→ Success of system depends upon these mentioned 3 aspects.

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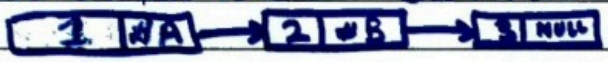
Q. No. 2 Part (II) **Stack v/s Queue:**

Stack	Queue
1. It works on LIFO (Last-In-First Out)	1. It works on FIFO (First-In-First-Out)
2. Similar to putting candies in a jar and then taking out the one at top.	2. Similar to waiting line in real life. The person at front is dealed with at the first.
3. 	3. 

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Q. No. 2 Part (iii) **Linked List:**

A dynamic form of data structure similar to array, but supports different data types and data stored in different non-contagious memory locations. Each node has two parts:
(1) Actual useful data (2) Pointer to other node



Advantages:

1. It supports different data types.
2. It is easier to add/remove new elements.

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Q. No. 2 Part (iv) **P-values:**

P-values are a measure of random chances in our supposed cause-effect relationship.

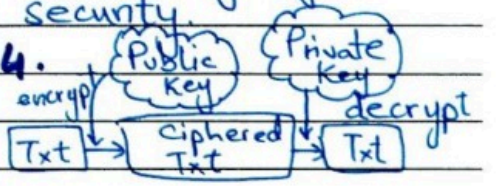
→ High p-values mean the effect was seen due to random chances and there is little conclusive cause-effect relation.

→ Low p-values mean effect was due to a solid cause-effect relation and random chances possibility is low.

→ P-values help us to accept or reject null Hypothesis (H_0). When p-values are high, we accept H_0. When p-values are low, we reject H_0. Therefore, they are very important in ~~significance~~ hypothesis testing.

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Q. No. 2 Part (v)

Symmetric	Asymmetric
1. It uses one same key for encryption and decryption	1. It uses one public key for encryption and one private key for decryption.
2. It is faster.	2. It is more time-consuming.
3. Relatively low security	3. Relatively high security.
4. 	4. 
Fig. Symmetric Cryptography	Fig. Assymmetric Cryptography

Q. No. 2 Part (vi) **Time Complexity:**

→ It is measure of how long it takes to get required output.

→ It is an estimation of algorithm's speed.

→ High Time Complexity means it would take longer to get the result.

Space Complexity:

→ It is a measure of how much space it takes during execution.

→ It is an estimation of algorithm's bulkiness.

→ High Space Complexity means it would take more memory for execution.

Computational Solution: Which one algorithm to choose depends on our priority of either time or memory.

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Q. No. 2 Part (vii) **Test-Train Split:**

➔ It is a ratio of data we use for model building.

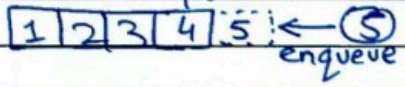
➔ Normally we take 60–70% Training data on which the model is trained.

➔ The rest 30–40% is used for Testing the model's performance. This is called Testing Data.

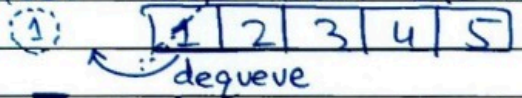
➔ If there are 100 cat and dog images then we can choose 70 images to train the model and use remaining 30 to evaluate how good the model is performing.

Q. No. 2 Part (viii) **Queue Operations.**

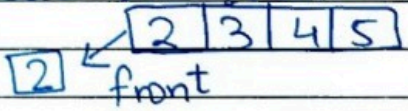
a) Enqueue: It adds a new element/node in the Queue at its back.



b) Dequeue: It removes the front-most node from the Queue.



c) Front: It outputs the front-most node at Queue without removing it.



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Q. No. 2 Part (ix) **Basic File Handling:**

1) Opening a file: Use open() function.
e.g.
f = open("abc.txt", "r") → opens in read-mode

2) Closing a file: Use close() function.
e.g
f.close()

3) With() Function: With() function automatically closes the file. e.g:
with open("abc.txt","r") as f:
rd=f.read() → Reading it; can be any operation.

Q. No. 2 Part (x) **A/B testing:**

→ A/B testing uses two different interfaces for users. Some users are given "Interface-A" and some are given "Interface-B".
→ We can individually check which interface is proven more usable for user by using analytics software.
→ When one interface shows more concrete results of being better at usability, then we can make it default.
→ Tech Companies frequently use A/B testing for their new prototypes. Better interface means higher usability and more success.

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Q. No. 2 Part (xi) **Cipher Method:**

→ Many cipher methods are used in Cryptography One is **Caeser cipher.**

→ In Caeser cipher, we use a specific value on the basis of which we swap the characters. It is a type of Substitution Ciphers.

→ For example:

Value: +3 ; Text: ABC

By going to +3 characters in Text we get: A → D B → E C → F

So, Cipher Text: DEF

We can go backs by opposite function of -3.

D → A E → B F → C

So, Text: ABC.

Q. No. 2 Part (xii) **Deep Learning:**

→ Deep Learning works in Robotics by using deep neural networks to understand complex data.

→ In order to add complex features like sight (Computer Vision), distinction in items (Classification), natural language processing (NLP) and others, huge amounts of data is required. Then the model needs to understand deep connections in data which is done by utilizing Deep Learning.

→ Therefore all human-like behaviour or decision-making ability requires deep connections training achieved via Deep Learning.

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Q. No. 2 Part (xiii) **Statistics Terms:**

i) **Mean:** It is the average value of all values. e.g. Data: 1, 2, 3, 4
Then Mean = $\frac{5}{2}$ or 2.5 (formula here: mean = $\frac{1+2+3+4}{4}$)

ii) **Median:** It is the centre-most value in dataset. e.g Data: 1, 2, 3, 4, 5
The Median = 3

iii) **Mode:** It is the most repeated or most frequent value. e.g Data:
1, 1, 1, 2, 2, 2, 2, 3
Mode = 2 → Repeated 4 times.

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Q. No. 2 Part (xiv) **Improving HCI:**

→ There are many ways to improve HCI. One way is **Accessibility Improvement.**
→ In this method, we add accessibility features. We make sure user of every demograph, disability or cultural background can use our system.
→ **e.g:** Many modern browsers use in-built text-to-speech mode. This way blind people can listen to browser articles. Github and other popular sites have High Contrast Modes for color-blind people.
→ We can include closed captions for deaf people and similarly tons of other features.

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Q. No. 3 (Page 1) **HCI problems:**

→ Human Computer Interaction (HCI) is a multi-disciplinary field that works on making interface to computers easier and more usable for humans.

→ HCI may face several problems. Two of them are discussed below:

i) Poor Error Messages:

→ If user makes a mistake on the system, the system should tell them what happened in non-technical terms.

→ In addition to that, system should also prompt the user what to do next.

→ Lack of clarity confuses the user and may lead to frustration and abondoning the product.

→ Therefore, it is crucial to make this process as user-friendly as possible.

→ **Example:**

- User is filling a form. He misses an important field. An error arises.
- Now if it outputs: "Error 6" on the screen then it is not clear and may confuse the user.
- But if we write it to output: "Important Field Left Blank! Please enter your email address", then it provides clear instructions.

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Q. No. 3 (Page 2)

ii) Usability Issues:

→ Usability determines how easy-to-use and comfortable is experiencing the system or product.

→ Low usability is a big problem and may lead to users quitting the product.

→ Design should be kept simple and Interface should be easy to understand.

→ **Example:**

- If too many features are crammed into a single screen, then users might find it difficult to find intend feature.
- Solution: Group similar features today, add a "Search Feature" bar at the top, and put most-used features in view of user.
- This way Simplicity is improved which addresses the Usability Issue.

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Q. No. 3 (Page 3)

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Q. No. 4 (Page 1)

Tree Traversal:

→ **Trees** are special type of Graphs. Tree is a heirarchical data structure, consisting of nodes. A **root node** is the top-level node. A **Leaf node** is the bottom-most node. Nodes have a parent-child relationship. Leaf nodes are the last so there are no children nodes after them.

→ **Tree Traversal** means a way to traverse a tree. There are 3 ways in general. 2 of them are as follows:

1) Pre-Order: In pre-order traversal we visit the root node first, then left and then right node.

Order:

ⓐ root ⓑ left ⓒ right

Use:

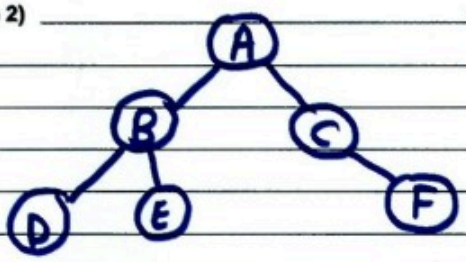
→ We use this traversal technique when we need to work with parent nodes first. Especially when we need to find root at first.

Example:

Consider the following tree:

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Q. No. 4 (Page 2)



Then its pre-order traversal would be:

→ A, B, D, E, C, F

ii) Post-Order Traversal:

In Post-Order Traversal, we visit the left node first, then right node, and the root node at the end.

Order:

(a) left (b) right (c) root

Use:

→ We use this traversal method when we need to work with children nodes first and the root at last.

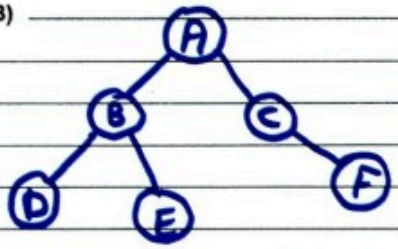
→ Deleting a Recursive Stack is an example of this.

Example:

Consider the following tree:

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Q. No. 4 (Page 3)



Then its post order traversal would be:

D, E, B, F, C, A

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Q. No. 5 (Page 1) **Cyberattacks:**

→ Cyberattacks refer to malicious activities carried out by attackers to gain personal interest by exploiting other users online.

→ With the widespread use of computers and Internet, cyberattacks are becoming more and more common. Two of these attacks are described below:

i) Distributed Denial of Service (DDOS):

→ In this attack, the attacker creates a network of infected devices and floods the target computer or server with too much traffic. This is continued until the device gets down.

→ The infected devices are called **Botnets** or **Zombie Computers**

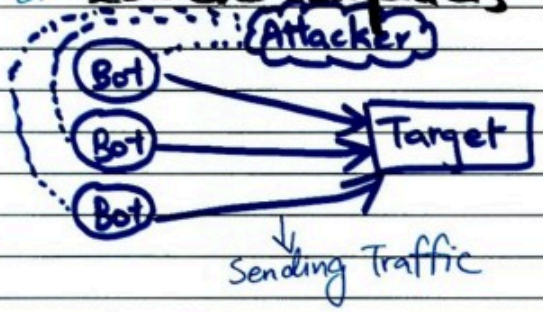


Fig. DDOS attack

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Q. No. 5 (Page 2)

Safety Measure:

→ For Servers, using a Firewall with a Cloudfare check (Captcha) is recommended.

→ For home computers, a Strong Firewall is recommend.

ii) Ransomware:

→ A Ransomware is a malicious software that encrypts user data without consent. Then it asks for ransom in exchange for a key to decrypt user's data.

→ This attack is very dangerous since the attacker may ask for very big amount to open the encrypted vault.



Fig: Illustration of how Ransomware work

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Q. No. 5 (Page 3) **Safety Measure:**

→ Do not download suspicious files.
→ Use antivirus software to scan regularly.
→ Check for security updates regularly.

The above three are for home users. For organizations also do these in addition to them:

→ Regular Security Audits.
→ Employee Training and Awareness.
→ Restrict Access Control.
→ Monitor Logs when suspicious activity is noticed and take immediate action.

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Q. No. 6 (Page 1)

Functional Programming:

→ Functional Programming is a programming paradigm that involves breaking down programme functionality in separate functions.

→ It focuses on "What to solve?" more, instead of "How to Solve?".

→ Many High Level Languages support this paradigm.

→ Some Programming Languages that support Functional Programming are Python, JavaScript, C++, Rust and C.

* Pros:

(1) It makes code more clear and easy to debug.

(2) Since everything is in separate functions so code is easier to maintain.

(3) It increases code modularity

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Q. No. 6 (Page 2)

★ **Cons:**

(1) It lacks advanced features like Polymorphyism and Inheritence etc., making it lengthy to code in it.

(2) It makes it harder to implement real-world objects like cars, vehicles, persons and immitate their behaviour. Object-Oriented Programming (OOP) is much easier for this.

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Q. No. 6 (Page 3)