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21 N T Z O P I - C S M L

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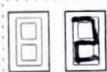
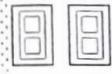
Please write question numbers in the following format: / Veuillez numérotter les questions en utilisant la présentation suivante: / Sirvase escribir los números de las preguntas en el siguiente formato:

1 2 3 4 5 6 7 8 9 10



- primary storage is volatile, whereas secondary storage is non-volatile.
- primary storage is directly connected to the CPU, whereas secondary storage will generally first be "loaded" on to a primary storage media before it can be accessed by the CPU.
- primary storage tends to have a much lower capacity than secondary storage, as it is only generally used when the computer is running.

②



$$\begin{array}{r} 8 \ 4 \ 2 \ 1 \\ 1 \ 0 \ 0 \ 0 \\ \downarrow \\ 8 \end{array} \quad \begin{array}{r} 8 \ 4 \ 2 \ 1 \\ 1 \ 0 \ 1 \ 0 \\ \downarrow \\ A \end{array}$$

$$\therefore 1000\ 1010 = 8A \quad \checkmark$$

①

a) a type of algorithm that will take an array of data, and then return an array of ~~the~~ the same ~~some~~ data elements, but in a particular order. Generally, this will either be numeric or alphabetical, and can be reversed ✓ (2)

b) **Bubble** sort will ^{review} iterate through check each item in an array, checking whether neighbouring elements are properly ordered. After a ~~After~~ number of pass-throughs will be completed until no changes need to be made. However, a selection sort involves systematically filling each index in the array by finding the next-most suitable element (using a type of linear search to find the next smallest/largest element). (2)

| X | Y | A | $(x > 5) \text{ XOR } A$ | (3) $x = 1$ | (4) $y + 2 = 4$ | (3) AND (4) |
|---|---|------|--------------------------|-------------|-----------------|-------------|
| 5 | 3 | TRUE | TRUE | TRUE = 1 | TRUE = 1 | TRUE = 1 |

∴ the boolean expression will return "TRUE", or "1" ✓ (2)

a) In a binary tree, each node will have ~~strictly~~ up to two children (can have can either be a leaf node, have one child, or two children). However, non-binary trees may have any number of children per parent node. (1)

b)

①

⑤

④

NOTE: left subtree was
traversed for the
greatest value.

②

Data compression refers to the act of reducing the size of a data file, either through statistical redundancy ("lossless") or through removing unnecessary detail ("lossy"). Either of these methods will reduce the required bandwidth within the network, and can work to significantly reduce the time it takes for a packet to travel through a network, with little-to-no disadvantages.

③

a) A ~~sub-program~~ will help reduce the complexity of code through abstraction; the complex details of how the sub-programs work are not required to be understood, so long as the appropriate methods are used to interact with it.

- identifier -

①

b) ~~Concurrent design will allow for multiple programmers to each work on specific components of the program at the same time.~~

A ~~software~~ product will have a variety of different components with a low level of interdependency. This means that developers and designers can ignore high level overviews, while working on different sub-components of the software. This way, design and development becomes much more efficient, as resources and labour can be used on separate aspects of design and development. However, if not done well, without an appreciation for the higher level integration design, a variety of ~~is~~ compatibility issues may arise with regard to integrating the different sub-programs together. ①

c) The program which requires the update can notify the user the next time they open it, that a software update is available. This would require the program to have access to ~~enter~~ an internet network. ① → more specific query

An ~~operating system~~ acts as an intermediary between hardware and software running on the program. By using device drivers, the OS can embody a layer of abstraction, as processes running on the layer above it do not need to concern themselves with hardware-specific complexities, but rather can more easily just interact with the OS layer which sits on top of the hardware layer.

① → kernel?



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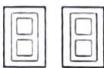
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ai) Surveys give access to a ~~very~~ potentially very large target number of people, such as end-users. They can be useful for receiving general feedback about a set of requirements, as a large number of stakeholders can have input. (2)



ii) Surveys often only provide quantitative data, and any qualitative data is usually very vague, and mostly where no follow-up questions may be asked. (2)



b) Interviews (with stakeholders like client or end user) (1)

c) - allow for interaction and feedback-gathering from the end user, as they get an idea of what the designed solution will be like: they are more likely to provide useful feedback when they can interact with the system themselves.

- helps prevent wastage during the development stage. e.g. a design flaw can be identified and fixed with a low-cost prototype, instead of investing more resources into fixing the final product.

(4)



d) computer system analysts, analysts, like all analysts and designers are unlikely to perfect the design of a program immediately. This is likely due to misunderstandings (e.g. communication barriers) between the stake client and end-users, and the analysts / designers. ~~likely~~ Further requirements and ideas may also be thought of after the initial planning and designing phase. These factors will often amalgamate into the need to alter / re-design entire plans before a costly development begins.

(3)

e) The proposed computer system has been identified as "new" system, meaning that it should ~~be~~ be thoroughly tested. This is because the system needs to have been beta-tested for both bugs and end-user acceptance. If any of these two components are ignored / not well done, the change management of the implementation of the new system is likely to be poor, and the end-user may stop using the system all-together.

(2)

b)

Look at different systems

as the network is "large," it is likely that it spans over multiple geographic locations (hence dictating the need for a WAN, for example). It is critical that the any sensitive data being transferred from occurs across the network is heavily encrypted.

- within the local area network of the company,

password protection is an efficient way to control who can access the network, stopping external entities from maliciously ~~maliciously~~ accessing sensitive data on the network. (3)

- a) - access to sensitive data can be managed by only giving access to certain individuals who have the authority to access it (usually higher ranking individuals within the organisation). This would likely be done using passwords.
- Physical prevention, such as a "data room", can be also used, whereby data is centralised in a single location. To access it, one would need to pass a ~~be~~ biometric authentication, hence allowing the number of people who have access to sensitive data to be managed.

c) data corruption:

- failsafe / failover
- repair corrupted files
- back-up : frequent

d) A VPN (virtual private network) refers to a network in which employees individuals can create or "tunnel" between themselves and another network, perhaps in a different geographical area. This tunnel would use high-quality encryption so that data that is intercepted over a long distance network like the Internet cannot be understood by the interceptor. (3)

Other advantages of VPN:

- reduce costs: BYOD
- remote workforce -
- access encrypting data: "encapsulated data packets".

→ review specific

(2) (1)

a) A GPS system will usually use a variety of satellites on ~~the~~ high-up aerial antennas to triangulate the position of a particular device, such as that which could be stored on a train. By measuring the amount of time it takes various signals to travel to and from the device, a centralized data hub (on Earth) can calculate the position, and then notify the necessary ~~info~~ systems/individuals on a network.

- atomic clock
- trilateration
- = from



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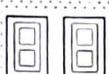
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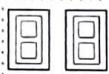
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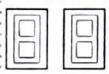


b) - status

①



bii) Sensors are the input device a type of ② input device on a control system which can provide information regarding the whether a train has passed a certain location on the network at a particular time. GPS is usually less accurate and less quick, however may be useful when requiring a train's location in more remote areas, where sensors have not been installed. In busier areas such as transport hubs, sensors could provide more accurate arrival information.



c) - The location of trains on the network could be made available to the user, as publicly-available real time GPS data can be accessed through using a network to connect the client (smartphone) to a server (GPS data server). ③ - The application could also use in-built GPS devices to show the user's position on a



map, which might be useful so that the user can navigate to a train station.

d. Advantages:

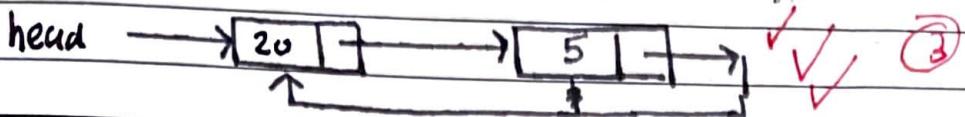
- lets the network operators centrally control transport operations through accessing GPS data in a single, centralised data.
- customers could receive more up-to-date information through the use of GPS, making the service better.
- GPS can often be used in more remote areas, where other Earth-based systems could not as easily track public transport services.

D) Disadvantages:

- GPS might be costly, especially when used on large networks of vehicles. This would likely add extra costs to the organisation.
- GPS also provides a very large amount of data, meaning time and resources need to be invested into setting up the centralised infrastructure to do so.

(4)

a)



b) upon iteration through the elements of the circular linked-list, if ~~an~~ the very first element is repeated, then the item before that signifies the end of the linked-list (as a loop has been completed). ② ③

1. Initialise TOTAL

c) 2. Begin at the head node ② ③

3. Traverse to the first element, pointed to by the 'head' node.

→ store this element in FIRST.

→ add this element to TOTAL

4. Traverse to the next node

→ if END of the node = FIRST

→ else, add the node to TOTAL

5. Repeat step 4. → ~~revise~~ node traversal

d)- Arrays are a type of ~~dynamic~~ static data structure, where a fixed amount of RAM is allocated upon initialisation. This cannot be changed, however does mean that ~~RAM~~ is random access, allowing for the efficient retrieval of information. ✓

=Linked lists are a dynamic data structure, which whereby each element points to the next. It, too, can store linear data, however data retrieval may be more inefficient due to traversal. ④

- e) - network ~~router~~^{router} processing packets with
 TIFO FIFO
 - print queues

a) 5.9 kilometers ✓ ①

b) Begin Valid (ROUTE-X-DISTANCES, A)

VALID = FALSE

loop I from 0 to A-1

 loop J from 0 to I

 loop J from I to A-1

 if ROUTE-X-DISTANCES [I][J] ≠ 0

 OR



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b) BEGIN Valid (R,A)

VALID = TRUE

loop I from 0 to A-1 :

if R[I][I] ≠ 0, then :

VALID = FALSE

end if

loop J from I+1 to A-1 :

if R[I][J] ≠ 0 or R[J][I] = 0, then :

VALID = FALSE

end if

end loop

end loop

output VALID

3

8

8



c) BEGIN distance (N, D, S1, S2)

~~IF~~

(6)

initialise INDEX1 = NONE

initialise INDEX2 = NONE

loop I from 0 to N.length - 1:

if N[I] = S1 ; then:

INDEX1 = I

end if

if N[I] = S2 ; then:

INDEX2 = I

end if ; end loop

if INDEX1 = NONE or INDEX2 = NONE , then:

output " station(s) not found "

end if.

// reordering INDEX1 and INDEX2

if INDEX1 > INDEX2 ; then:

TEMP = INDEX1

INDEX1 = INDEX2

INDEX2 = TEMP

end if.

// ~~else~~ find distance and output

DISTANCE = D[INDEX2][INDEX1]

output DISTANCE .

END

d) BEGIN

(2)

- to loop through all bus stations between the origin and destination, each time adding onto the total.

- between lower & higher routes

DO NOT REQUIRE PSEUDOCODE