Diploma Programme
Programme du diplôme
Programa del Diploma

Computer science
Higher level
Paper 1

Monday 20 May 2019 (afternoon)

2 hours 10 minutes

Instructions to candidates

- Do not open this examination paper until instructed to do so.
- Section A: answer all questions.
- Section B: answer all questions.
- The maximum mark for this examination paper is **[100 marks]**.

$\frac{83}{100}$ = 83%.

Time taken: 2 hours.

2219–7011

ANSWER BOOKLET
LIVRET DE RÉPONSES
CUADERNILLO DE RESPUESTAS

0

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4 PAGES / PÁGINAS

Candidate session number: / Numéro de session du candidat: / Número de convocatoria del alumno:

1	9	M	T	Z	[redacted]	P	1	-	C	S	M	L

Candidate name: / Nom du candidat: / Nombre del alumno: Jamie Sullivan

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

1 2 3 4 5 6 7 8 9 10

8 1

a peripheral is an external hardware device that connects to a computer in order to provide additional functionality, such as a keyboard, mouse or printer.

8 2

1: ~~too~~ toolbar ×

2: Navigation menu ✓

8 3

The memory address unit ~~holds~~ temporarily holds the address ~~that~~ of a piece of data that needs to be written to / read from RAM during the machine ~~instruct~~ instruction cycle. It is located within the control unit (CU), hence also the ~~CPU~~ central processing unit (CPU)

(4)

4

3D ~~graphics~~ graphics often require multiple processes to be run simultaneously, such as that which completes logical operations, as well as rendering the graphics onto a resource-demanding monitor. A single CPU core cannot multitask, meaning the above operations must be delegated different amounts of CPU time.

8

5

a) advantage of virtual memory: will artificially expand the limited capacity of RAM by paging RAM, and swapping it out with secondary storage with regard to a set of memory management policies set by the memory management unit.

8

b) may slow down the speed of processes because that may be stored in secondary storage will use up time and computational resources that would otherwise be available to other processes.

6

b

1 1 0 1 = 13 1 1 1 1 = 15

8 4 2 1 8 4 2 1

10 11 12 13 14 15
A B C D E F

∴ 1101 1111 → DF ✓

7

A	B	C	S	Z	
0	0	0	0	0	
0	0	1	0	1	✓
0	1	0	0	0	✓
0	1	1	0	1	
1	0	0	0	0	
1	0	1	0	1	
1	1	0	0	0	X
1	1	1	1	1	

8

- ~~Collecting~~ surveys can be used to collect information from a large group of people such as the public on what ~~a~~ new ~~syst~~ features and requirements a new system should have.

5

9

- A personal area network (PAN) is a short range network, constricted to a geographic location
- A PAN will mostly contain only devices which are connected to a single device/computer through technologies such as bluetooth.

10

Computers are There

There are a wide ~~tot~~ variety of computers, each with their own system architecture and software. Because networks are made up of an amalgamation of these devices, there needs to be set rules (~~protocols~~ protocols) which each computer must follow in order to be able to properly transfer information between ~~nodes~~ devices on a network.

Candidate session number: / Numéro de session du candidat: / Número de convocatoria del alumno: 19 M TZ 0 P 1 - C S M L

Candidate name: / Nom du candidat: / Nombre del alumno: JAMIE SULLIVAN

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1 2 3 4 5 6 7 8 9 10

8

Post-order : LRV

⇒ 76, 75, 79, 70, 68, 72, 83 ✓✓

9

address books are usually easily sortable (e.g. by street name or house number), have they would suit a binary tree well. This way, drastic ↓ computer ✓ resources could be saved through the efficient binary tree searching algorithms, which becomes all the more prominent in searching through, for example, a linked list, where the worst case scenario is considerably bad.

(1)

- talk about quick addition and removal
- listing using Inorder

(3)

a) - human error: inconsistencies in the manual input or data management completed by employees. For example, the mail company may require employees to manually edit customers orders, where such processes could result in accidental deletion or changing of information.
- physical data loss is also possible, as large amounts of data often need to be stored in large data warehouses, where physical hard drives may fail due to age or other physical damage.

b) - continual online backups would enable the company to quickly store data in an online location. Whether it is a physical server operated by the company, or a SaaS solution, this will ensure data is continually saved in a different location.
- physical data transfer and storage refers to a process by which hard drives are physically duplicated and transported to different geographic locations, as to ensure redundancy if one were to fail.

(2)
- Incremental backup
- Failover / disk mirroring

(6)

c) New user interfaces will often introduce a ~~to~~ variety of new features, such as a new layout. Beta testing will often be used with a select few people, or a limited proportion of the target market, in order to ensure the new features of the UI successfully fulfill the intended purposes, as ~~well~~ well ~~as~~ as fixing a variety of bugs which may accompany wider-scale use. ~~This~~ Beta will likely give programmers the opportunity to find edge-case scenarios they did not even know existed.

d) a program should only be made with the end user in mind, as to ensure the ~~developed features~~ designed features are geared towards their intended use, rather than the programmer's idea, which will often not fulfill the criteria.

① - user-friendly
- may be missing key features.

e) ~~- text-to-speech sources w~~
- tool tips: used to give more detail about UI elements, in case the user is older or visually ~~to~~ impaired.
- colour contrast: for those whom have more difficulty reading text / finding ~~the~~ elements of a UI, a ~~the~~ clear and consistent contrast scheme could be used.

6

14

a) - RAM is volatile, meaning that anything stored on it is lost if power supply is lost.
- RAM is usually high speed (in comparison to secondary storage), making it useful to store currently running software as to reduce bottlenecks within the CPU.

b) To provide high-capacity, long term, non-volatile storage in order to store the operating system and any other data/applications stored on a computer.

c) - word processor
- internet browser

① - more efficient training

di) familiarity: teachers will be more familiar with their own devices, hence training costs and time required are likely to reduce.

dii) security: allowing other devices onto the network can pose a safety risk if the proper safety methods are not implemented. The wireless aspect further amplifies this, as the company has even less security control.

(8)

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19

e) whitelisting ~~(or blacklisting)~~ could be used to ~~#~~ enable only "verified" devices to join the wireless ~~networ~~ network. This way, the company would have full control over whom connects ~~#~~ to their network, by systematically adding the ~~teacher's~~ teachers' MAC address to a whitelist.

f) wireless access points (WAP)

- backlog in the ~~routers~~ attempting to send and recieve all the required packets. WAP ~~If the router~~ becomes inundated with packets, due to the large number of teachers in the training room, then the packets will likely be queued, however this would likely result is slower transfer ("throughput").
- Wireless networks are often prone to physical interference, whether this is due to walls (which is unlikely in the single training room), or simply human bodies, the quality of the transmitted signals may be ~~reduced~~ reduced.
- Signal quality also degrades with distance. Teachers further from the ~~WA~~ WAP will experience slower ~~th~~ throughput.

6

15

a)

COUNTER1	MINIMUM	COUNTER2	Array VALUES[] [0]	[1]	[2]	[3]	[4]	TEMPORARY
0	0	1	20	6	38	50	40	~~0~~
0	1	2	~~6~~	~~20~~	~~38~~	~~50~~	~~40~~	
		3						
		4						
			6	20	38	50	40	6
1	1	2						
		3						
		4						
2	2	3						
		4	6	20	38	50	40	
3	3	4						
	4		6	20	38	40	50	40

⇒ REVISE

(4)

D)i) BEGIN

```
LIMIT = 4
FLAG = TRUE
loop while FLAG IS TRUE
    FLAG = FALSE
    COUNTER = 0
    loop COUNTER from 0 to LIMIT-1
        if VALUES[COUNTER] > VALUES[COUNTER+1]
            TEMPORARY = VALUES[COUNTER]
            VALUES[COUNTER] = VALUES[COUNTER+1]
            VALUES[COUNTER+1] = TEMPORARY
            FLAG = TRUE
        end if
    end loop
end loop
END
```

bii) Bubble sort

c) BEGIN outputArray (VALUES[])

```
length = VALUES.length()
loop COUNTER from 0 to length
    output VALUES[COUNTER]
end loop
END
```

(6)

d) – a dynamic data structure is one which is not bound to a specific "chunk" of memory. Hereby, one element will simply point to the next, like a linked list (NOTE; this is an abstract logical overview).
– a static data structure, like an array, is assigned a set amount of RAM upon initialisation. This way, the size of a ~~dy~~ static data structure cannot change post-initialisation.

e) Linked list

6 a) – peripheral management: act as an intermediary between an external hardware device and the processes ~~currently~~ currently running on ~~the~~ ~~com~~ computer.
– Virtual RAM management: If the computer is running low on primary memory, the ~~OS~~ OS will page ~~it~~ and swap memory with secondary storage, while abstracting this and to ~~external~~ ~~software~~ software operating on top of it.

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18

b) a dedicated operating system will be specifically targeted towards the hardware in the system. In the case of the smart home system, the very specific functionality, with air conditioning, burglar alarms, and surveillance systems would be difficult to cater to using just a generalised operating system, as specific software would not have been developed for the very targeted use case. (2) → reuse

c) - sensors: act as an input to the ~~centrally~~ centralised control system, whereby the surrounding temperature is sensed as an analogue signal. This signal would then be digitised through an analogue to digital ~~converter~~ converter, whose subsequent digital signal would then be sent to the microprocessor.

- microprocessor: upon recieving a digital signal, it will compare it with the user-defined "target" and send an output digital signal to the actuator accordingly, through a digital-to-analogue converter. Note that the actuator refers to the heating devices themselves.
- Feedback: the loop above repeats.

(6)

d) a distributed air conditioning system would have a control system at every heater in the house (likely every room). This would provide a more ~~spec~~ tailored management of temperature at each node, as individual temperature sensors could cater to the differing needs of each room in the most home. However for the purposes of maintaining a "constant" temperature in the home, a centrally controlled system could also be useful, ~~as each of the~~ as the entire system can be set from a single point.

(2) → failure points
→ expansibility
→ installation difficulty etc.

a)

```
BEGIN searchCardiff (CUSTOMERS[])        I = 0
    loop COUNTER from 0 to 511
        CUSTOMER = CUSTOMERS[COUNTER]
        CITY = CUSTOMER[5]
        if CITY equals "cardiff", then
            I = I+1
        end if
    end loop
    output I
END
```

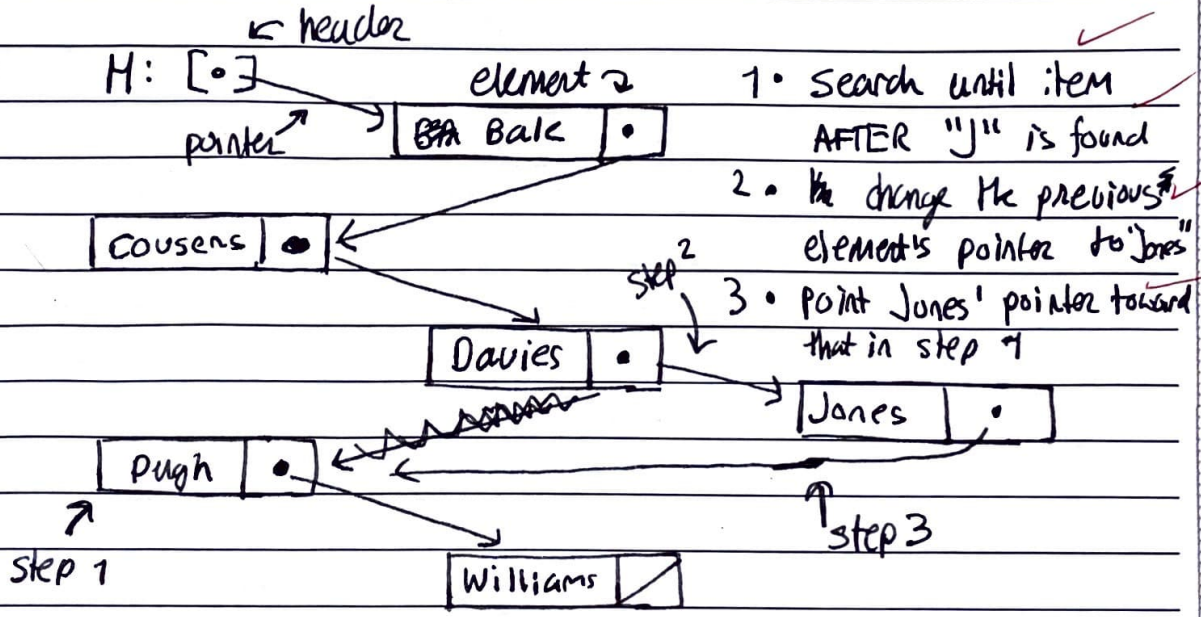
b)

```
BEGIN searchJonesCardiff (CUSTOMERS[])

    loop COUNTER from 0 to 511:
        CUSTOMER = CUSTOMERS[COUNTER]
        if CUSTOMER[0] equals "Jones", then:
            if CUSTOMER[5] equals "Cardiff", then:
                printLabel(CUSTOMER)
            end if
        end if
    end loop.
END
```

← not proper output (2)

c)



(7)

d) A circular list is useful when:
- any node can be a starting point
- Media list that plays endlessly.

etc.