ST ANDREW'S CATHEDRAL SCHOOL
FOUNDED 1885

Y12 Computer Science
Semester 2 - Higher Level
Paper 1

22	T	R	L	~~xxxx~~	P	1	CS	H	L

Thursday 25th August 2022

2 hours 10 minutes

Instructions to candidates

- Do not open this examination paper until instructed to do so.
- Section A: answer all questions. *[25 marks]*
- Section B: answer all questions. *[75 marks]*
- The maximum mark for this examination paper is [100 marks]
- Make sure all your responses are clearly labelled with their question number.

83
100

IB practice exams 2022

ANSWER BOOKLET

4 PAGES

A 21/25 B 62/78 83/94 83/100

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Candidate session number: 0033376-0041

Candidate Name: JAMES SULLIVAN (17)

At the start of each answer to a question, write the question number in the box using your normal handwriting

Example 27 | 2 | 7 |

Example 3 | | 3 |

1

- clear syntax and grammar conventions
- clear set of vocabulary (e.g. "print") 2

2

When computers wish to access ~~the~~ a server on the internet, they must ~~be~~ know the specific IP address of that server. Hence, it will request the specific address by sending the name to a DNS server, which will return the respective IP address. 1

resource

what is sent?

heart mind life

3

3

A	B	C	A AND B	A AND B XOR C
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	1	1
1	1	1	1	0

2

4 a) lets the system analyst get an appreciation for the end-user's environment and the functionality that would be required within it.

b) time consuming as the analyst should observe for an extended period of time.

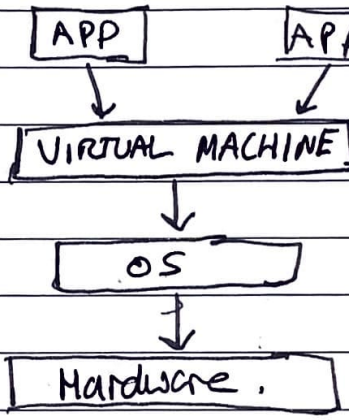
4

5 Using API's for data input so that specialised devices ~~(e.g. braille s~~ (e.g. for motor diseases) can be used as input devices.

How might a user input data?
Identify a method e.g. Voice to text

5

6 A virtual machine acts as a layer ~~ontop~~ on top of that of the operating system, which is used to emulate the functionality of a different operating system. Any applications operating on top of the VM will have the specific functionality of the underlying operating system abstracted out (as shown in the diagram). This is useful for testing software on different platforms, because they can simply be "emulated" on the developer's computer. without having to...?



2

0x ← often used to denote hex.

7 0xAE? "x" is not hexadecimal?

2

AE = 174 ✓

↑ ↑

10×16 + 14 = 160 + 14

= 174

8

- Acts responds intelligently to changes in the surrounding environment ("the larger system")

- acts on behalf of the owner, to complete actions in the external environment autonomously

2

A	B	A×2+B	A+1	A<5	output
1	1	3	2	T	
2	3	7			

A	B	A<5	OUTPUT
1	1	T	1
2	3	T	2
3	7	T	3
4	13	T	4
5	21	F	~~21~~
			21

3

5

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(14)

Example 27 [2][7] Example 3 [ ][3]

10

- the contents are stored in non-contiguous locations in ram (elements do not have to be next to each other) ✓

- size of the data structure is dynamic as the program is being run.

No BOD.

↑ You need to define this (it's what the question is asking).

11

a) Q and S ✓

b) i) inorder = LVR :

Q, P, S, R ✓

ii) preorder : VLR :

P, Q, R, S ✓

1

1

1

4

[1] [2]

a) - Ethernet (usually by fibre optic) is a form of high speed data transfer which is very secure, given only authorised peer devices are connected to the access points. This is very useful if students are in just one location, close to an access point in the wall
- Wireless LAN (WLAN) networks offer uptmost flexibility, which is important for the student's personal devices. It is unlikely they will always be near a wired access point, however Wireless access points are highly versatile in that a signal can be accessed in most locations which are in-range.
- Wireless data transfer is less secure, which could cause a problem for the students.
- Wireless data signals are also easily interfered with, which could detract from the described "high-speed" network of the campus.

b) client software & hardware.

Needs to be clearer I think

3 NoBOD

I don't think so.

why?

No BOD.

I think you need to say VPN Client software...

3

c) - The VPN will create a secure, encrypted tunnel between the remote device and the university server. ✓ likely, the client software will use an advanced type of ~~sym~~ symmetrical ~~eg.~~ encryption to ensure that all data travelling over the network ~~is~~ ~~c~~ is not understandable by other ~~pr~~ entities.

How does this help?

- The VPN will also hide the IP address of ~~the~~ the client computer, by replacing it with that of the server once it reaches the university's network. This way, the user's identity is not revealed to any websites / entities on the internet. 2

There are two parts to the question.

13

a) Software-as-a-service is a method through which an organisation may use the servers / technologies of an external organisation to provide ~~business~~ services which would need to otherwise be stored on-premise. This way, a fee is paid to the SaaS provider, as they must incur the costs of maintenance of their service, while also being responsible for upgrades / updates of their service. An example could be using an external provider to store data (e.g. OneDrive), so that it need not be stored in expensive local servers. 2

Need to address the idea of hosting in a virtualized cloud based environment

More to it.

b) - SaaS involves using an external provider to store information. Trust must be placed in them to uphold confidentiality to sensitive content stored on the server.
- Data must be stored in external locations, not in control of the organisation . . ?
- maintenance / updates / patches of software are outside the control of the organisation, which could directly relate to the security of the data on the system.
- reliance on the SaaS provider to remain operational - if they must shut down, data loss is a possible threat.
- To communicate with the SaaS server, confidential data must be sent over a WAN (such as the internet), which could be a cause of security loss due to, for example, malicious activity.

3

You've doubled up too much.

Are there implications re jurisdictions? How can these be addressed?

3

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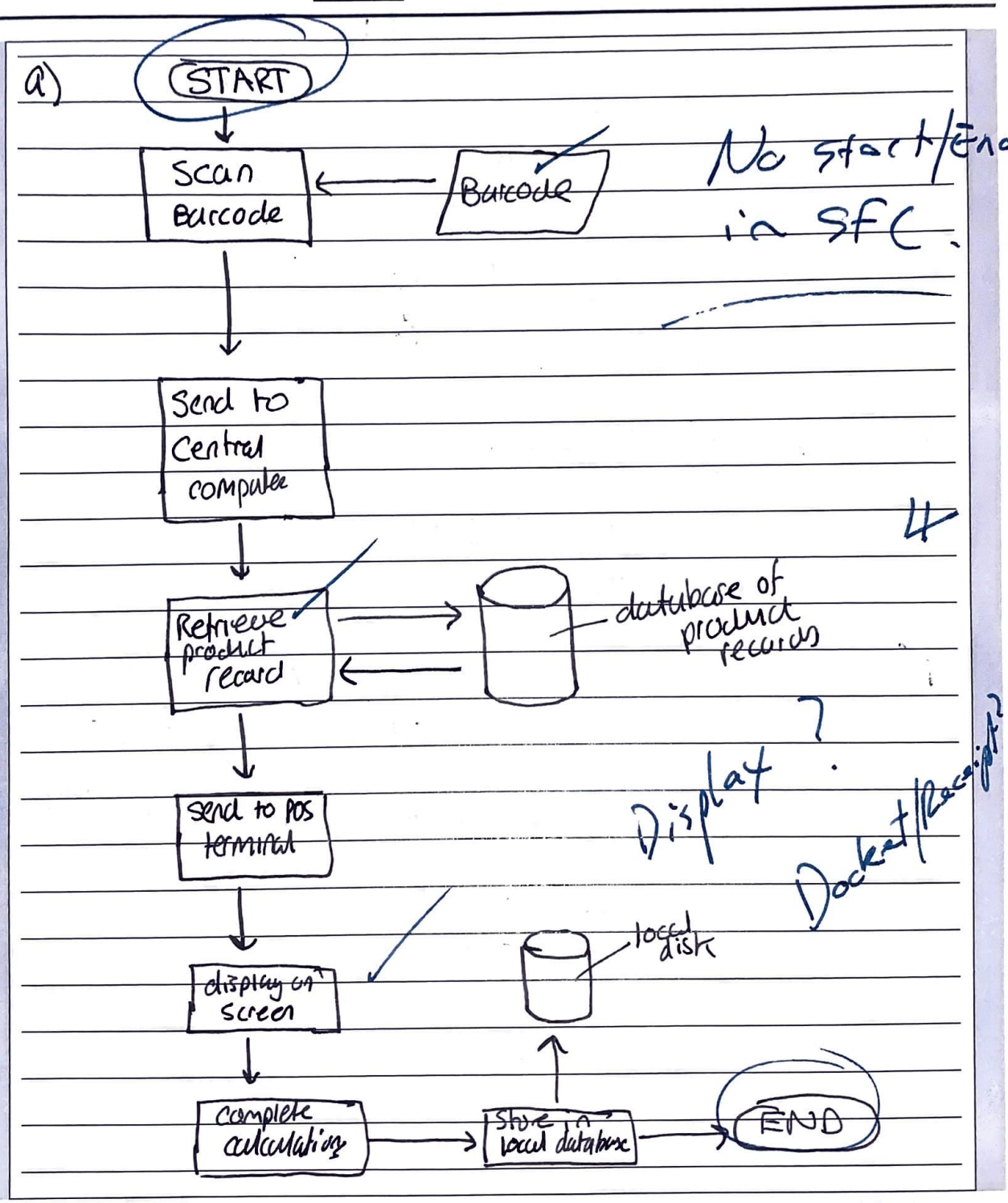
25

Example 27 [2][7] Example 3 [ ][3]

14

a)



No start/End in SFC.

4

Display ?

Docket/Receipt?

heart mind life

4

b) - CPU scheduling: this involves allocating CPU time to all the requests from each point-of-sale computer (most likely done through implementing FIFO). This is an example of multitasking all requests.

- ~~Memory Management~~: Virtual Memory will

4

- Memory management: using virtual memory will likely be crucial in ensuring that if too many requests are happening concurrently, there will always be enough virtual RAM to handle them all.

15

a)
```
PASSENGERS.resetNext()
I = 0
2D_ARRAY[30][7]
loop while I < 30
    J = 0
    loop while J < 7
        2D_ARRAY[I][J] = PASSEN
        if PASSENGERS.hasNext(), then
            2D_ARRAY[I][J] = PASSENGERS.getNext()
        end if
        end loop
        J = J + 1
    end loop
    I = I + 1
end loop
```

4

8

b)
```
BEGIN total(COL)
    // NOTE: COL refers to the index (eg. 0,1,2,...)
    Initialise 2D-ARRAY
    SUM = 0
    ROW = 0
    loop while I < 30
        SUM = SUM + 2D-ARRAY[I][COL]
        I = I + 1
    end loop
    output SUM
END total()
```

NOT SURE ABOUT THIS. WHY IS IT HERE?

4

c)
```
Initialise 2D-ARRAY
DAY_COUNT = 0
DAY_ARRAY [7]
loop DAY_COUNT from 0 to 6
    DAY_ARRAY[DAY_COUNT] = total(DAY_COUNT)
end loop

// find maximum day (day with highest total
MAX = 0
MAX_INDEX = -1
loop I from 0 to 6
    if DAY_ARRAY[I] > MAX, then
        MAX = DAY_ARRAY[I]
        MAX_INDEX = I
    end if
end loop
AVERAGE = MAX div 30  // ignore decimal
output (AVERAGE)
output (convert(MAX_INDEX))
```

averaging will be completed in output

integer part only useful

3

7

```
BEGIN salesCalculate(S_ROW, S_COL, E_ROW, E_COL)
    Initialise 2D_ARRAY ; Initialise FEES
    TOTAL = 0
    ROW = S_ROW
    COL = S_COL
    CONTINUE = TRUE

    loop while CONTINUE = TRUE:
        NUM_PASS = 2D_ARRAY[ROW][COL]
        if COL < 5, then // weekday
            TOTAL = NUM_PASS * FEES[0] + TOTAL
        else : TOTAL = NUM_PASS * FEES[1] + TOTAL
        end if

        // stopping condition
        if ROW == E_ROW AND COL == E_COL then
            CONTINUE = FALSE
        else:
            // increment row and col
            if COL == 6:
                ROW = ROW + 1
                COL = 0
            else:
                COL = COL + 1
            end if
        end if
    end loop
    output TOTAL
END salesCalculate()
```

NOTE: S=start E=end

We don't init these, that already done.

6

6

ANSWER BOOKLET (4)

4 PAGES

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Candidate session number

0	0	3	3	7	6	-	0	0	4	1

Candidate Name

JAMES SULLIVAN

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Example 27 | 2 | 7 |

Example 3 | | 3 | No. This is different

18

16

a) - memory management using Virtual memory, or VRAM, which involves paging memory into ~~chunks~~ small pages ("chunks of memory"), and swapping them out with secondary storage. With the servers, this is most likely to occur if it becomes inundated with requests, and cannot handle them all with its finite amount of RAM.

No BOD. I think this needs a little work.

- CPU scheduling will be used to ensure that all requests ~~are~~ ~~all~~ of the server are attended to in an orderly fashion. Clients are likely to simultaneously request data from the email and database servers, so it is most likely that the OS will use a FIFO (queue) system to ~~attend~~ schedule CPU time for all requests. 3

heart
mind
life

3

b) ~~An operating system will act as an intermediary layer between i~~

Often, programs will request data from peripherals, which will take some time to get a response. Hence, the OS will stop that program from running (by swapping it with other pending processes), and ~~at~~ either:

- continually poll the hardware device ~~to s~~ (peripheral) to see if it is ready with a response.
- wait for an interrupt from the peripheral devices, to be given CPU attention again.

2

This is actually an SL q. So what you started writing was on the right track.

c) - A laptop-computer requires relatively little memory, as it only needs to store memory for the OS and processes currently open on the computer (for a single user).
- However, a server often needs to handle a variety of requests from a range of different ~~clients~~ client computers, each being allocated memory to. This could require considerably more memory than the single laptop.

2

Good

4

c ii) - Like with memory, the laptop only needs to have enough processing power to provide CPU time to the applications and processes currently on the computer. This might involve multitasking, but the processor requirement is still relatively small.
- A server will need enough processing power to schedule requests from a large number of processes.

How many people wait if there is a delay?

d) – temperature sensor ✓
– motion sensor (OR pressure sensor in the driver's seat). ✓ 2

How does the data get in...?

e) - Analogue data is output from both the temperature and motion sensor (OR pressure sensor)
- It is converted to a digital (electronic) signal through an ADC ✓
- The microprocessor will recieve the temperature and pressure reading as a digital signal, and likely have an "AND" logic gate: 4
  - (Temperature > {user defined} OR Temperature < {user defined}) AND Pressure > {certain level which indicates driver in seat}.
- The microprocessor will send a signal to the actuator (through DAC) ~~to~~ accordingly, to increase or decrease temp

1 6

- a timer will be set by the microprocessor, after which another signal is sent (through DAC) to switch off the actuator. ✓

17

→ stacks would operate using a LIFO system, meaning the packets ~~would need to be~~ that arrive last would be sent out first, which does not work in a queueing system like this (e.g. packets at the bottom of the stack may never be sent).

→ queues better represent this system, using FIFO to let the packets that have been waiting the longest be sent in priority order. This is ideal for this system.

4 → The ~~queue~~ queue above can be implemented using linked lists, which would be good as they are dynamic → ~~as~~ we do not know how many packets will at one point be waiting in the queue, meaning linked lists can be used as a dynamic data structure.

would be good to explain linked lists I think.

4

IB practice exams 2022

ANSWER BOOKLET (5)

4 PAGES

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At the start of each answer to a question, write the question number in the box using your normal handwriting

Example 27 [2][7] Example 3 [ ][3] [9]

[1][8]

a)

COUNTER 2	STRING 2
0	"Y"
1	"YL"
2	"YLL"
3	"YLLI"
4	"YLLIS"
5	

2

b) ~~loop while~~ COUNTER3 = 0
PALINDROME = TRUE
loop while COUNTER3 <NUM AND ~~NOT~~ PALINDROME =TRUE

2

b) COUNTER3 = 0
PALINDROME = TRUE
loop while COUNTER3 < NUM AND PALINDROME == TRUE :
~~if STRING1[COUNTER3] == STRING2[COUNTER3], then :~~
~~PASS~~
if STRING1[COUNTER3] != STRING2[COUNTER3], then :
PALINDROME = FALSE
end if
COUNTER3 = COUNTER3 + 1
end loop
if PALINDROME == TRUE :
output "Palindrome!!"
else: output "Not a palindrome :c"

c) - A stack can be implemented as an array, so long that the array is long enough (larger than the potential maximum ~~stack~~ stack size). There would need to be a COUNTER, which points to the next free element in the array / stack. The methods would be designed as follows:

PUSH : ARRAY[COUNTER] = newItem
COUNTER = COUNTER + 1

POP : removedItem = ARRAY[COUNTER - 1]
COUNTER = COUNTER - 1
output removedItem

~~ISEMPTY~~ ISEMPTY: If COUNTER == 0 : output TRUE
else: output FALSE.

Note: the previous algorithms do not regard checking is the array is full or empty ~~while~~ during push() and pull() : this is easily done by checking COUNTER against the array length, however is a limitation of using a static data structure ~~for~~ for what is a dynamic concept (stacks)