Purpose Of An Operating System

Question 1

Blocked

8 **(a)** A computer process can be in one of three states.

Identify **and** describe **two** of these states.

State 1 Running .....

Description The process is beig actively being exceuted .....

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.....

State 2 Ready .....

Description The process is in the queue iits not exceuetd yet .....

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[6]

(b) One of the main tasks of an operating system is resource management.

Describe how an operating system can maximise the use of resources.

Primary memory .....

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Disk .....

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[6]

Question 2

6 **(a)** An operating system (OS) uses a memory management technique called paging.

Explain what is meant by the following terms.

Page Virtual Memory divided into blocks of fixed size

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Page frame The main memory is dvided into page frames of the same size as a page

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Page table The page (map) table shows the mapping of pages

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[3]

(b) Explain why an operating system needs to use scheduling algorithms.

allow for multi tasking
fair ussage of prcessor
fair ussage of hardware

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..... [3]

(c) State what is meant by an **interrupt**.

A signal fro, a software soirce or hardware devied seekin attention of a processor

..... [1]

(d) For a computer system using multi-programming, the low-level scheduler decides which process will get next use of the processor.

One algorithm could be a round-robin, which means every process gets use of the processor in sequence for a fixed amount of time (time-slice).

For a round-robin algorithm, five processes are currently loaded and get the use of the processor in the sequence:

JOB21 – JOBSS – JOBPT – JOB32 – JOB42, then return to JOB21

Process JOB32 has just completed its time-slice.

The following paragraph describes what happens next. Complete the paragraph by inserting the missing processes.

Interrupt received from the low-level scheduler. Save all register contents for JOB32 .

Copy the saved registers for JOB42 to the CPU.

The processor will now process JOB42 .

[3]

Question 3

4 Physical memory is managed using virtual memory and paging.

(a) Describe what is meant by **virtual memory**.

When the os utilised secondray storage to use as random access memory when

cpu needs to free up memory space

data is swapped b/w RAM and disk

..... [2]

(b) (i) Explain how paging is used to manage virtual memory.

RAM GETS DIVIVED INTO FRAMES

VIRTUAL MEMORY GETS DIVIDED INTO SAME SIZE CALLED FRAMES

A page table is set up to leep track of all free frames and swap the pages in memory with new pages from disk when needed

[4]

(ii) Give a suitable page replacement algorithm for this process.

First in first out / Least-used page

[1]

(iii) One drawback of using virtual memory is disk thrashing.

Describe what is meant by the term **disk thrashing**.

when there is a continous swapping of data b/w the memory and disk causing high latency and low cpu utilisation

[2]

Question 4

5 A computer process can be in one of three states: running, ready or blocked.

(a) Explain how the processes are affected when the following events take place.

(i) The running process needs to read a file from a disk.

the process is tranfered from a running state to a blocked state until the files is accessed another proess is loaded up

[2]

(ii) The running process uses up its time slice.

the running state goes from running to blocked meanwgile the waiting state shifts to

Ready to RUnning

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.....[2]

(b) **(i)** State the conditions that are necessary for a process to move from the ready to the running state.

it doesnt need an event to occur to proess

there is no interyupt events

there are no processes of higer priottye

.....[2]

(ii) State the conditions that are necessary for a process to move from the blocked to the ready state.

required resource becomes avaible and event is completed

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.....[2]

(c) Give **three** reasons why process scheduling is needed.

1 .....

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2 .....

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3 .....

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[3]

Question 5

3 A computer operating system (OS) uses paging for memory management.

In paging:

- main memory is divided into equal-size blocks, called page frames
- each process that is executed is divided into blocks of the same size, called pages
- each process has a page table that is used to manage the pages of this process

The following table is the incomplete page table for a process X.

Page	Presence flag	Page frame address	Additional data
1	1	132	
2	1	245	
3	1	232	
4	0	0	
5	1	542	
6	0	0	
⌒	⌒	⌒	⌒
135	0	0	

When a particular page of the process is currently in main memory, the Presence flag entry in the page table is set to 1.

If the page is not currently present in memory, the Presence flag is set to 0.

(a) The page frame address entry for Page 2 is 245.

State what the value 245 could represent.

..... [1]

(b) Process X executes until the next instruction is the first instruction in Page 4. Page 4 is not currently in main memory.

State a hardware device that could be storing this page.

..... [1]

(c) When an instruction to be accessed is not present in main memory, its page must be loaded into a page frame. If all page frames are currently in use, the contents of a page frame will be overwritten with this new page.

The page that is to be replaced is determined by a page replacement algorithm.

One possible algorithm is to replace the page that has been resident in main memory for the longest time.

(i) Give the additional data that would need to be stored in the page table.

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..... [1]

(ii) Complete the table entries below to show what happens when Page 4 is swapped into main memory. Assume that Page 5 is the one to be replaced.

In the final column, give an example of the data you have identified in **part (c)(i)**.

Page	Presence flag	Page frame address	Additional data
4	.....	.....	.....

[3]

An alternative algorithm is to replace the page that has been used least.

(iii) Give the different additional data that the page table would now need to store.

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..... [1]

(iv) In the following table, complete the missing data to show what happens when Page 3 is swapped into main memory. Assume that Page 1 is the one to be replaced.

In the final column, give an example of the data you have identified in **part (c)(iii)**.

Page	Presence flag	Page frame address	Additional data
3	.....	.....	.....

[3]

(d) Explain why the algorithms given in **part (c)** may not be the best choice for efficient memory management.

Longest resident .....

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Least used .....

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..... [4]

Question 6

6 A number of processes are being executed in a computer.

(a) Explain the difference between a program and a process.

a programm is writen in static code .....

a progesss is the exeutin cid=ode .....

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.....[2]

A process can be in one of three states: running, ready or blocked.

(b) For each of the following, the process is moved from the first state to the second state. Describe the conditions that cause each of the following changes of the state of a process:

From running to ready .....

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From ready to running .....

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From running to blocked .....

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.....[6]

(c) Explain why a process cannot be moved from the blocked state to the running state.

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.....[3]

(d) Explain the role of the high-level scheduler in a multiprogramming operating system.

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.....[2]

Question 7

6 A number of processes are being executed in a computer.

A process can be in one of three states: running, ready or blocked.

(a) For each of the following, the process is moved from the first state to the second state. Describe the conditions that cause each of the following changes of state of a process:

From blocked to ready .....

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From running to ready .....

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.....[4]

(b) Explain why a process cannot move directly from the ready state to the blocked state.

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.....[3]

(c) A process in the running state can change its state to something which is neither the ready state nor the blocked state.

(i) Name this state.

.....[1]

(ii) Identify when a process would enter this state.

.....[1]

(d) Explain the role of the low-level scheduler in a multiprogramming operating system.

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.....[2]