

Preview Test: COMP3301/7308 Semester Two Deferred/Supplementary Examination 2020

Test Information

Description Undertaking this online examination deems your commitment to UQ's academic integrity pledge as summarised in the following declaration:
"I certify that I have completed this examination in an honest, fair and trustworthy manner, that my submitted answers are entirely my own work, and that I have neither given nor received any unauthorised assistance on this examination".

Instructions You need to answer all of the questions in the BlackBoard Test.

Timed Test This test has a time limit of 2 hours and 30 minutes. This test will save and be submitted automatically when the time expires.
Warnings appear when **half the time, 5 minutes, 1 minute, and 30 seconds** remain.
[The timer does not appear when previewing this test]

Multiple Attempts Not allowed. This test can only be taken once.

Force Completion This test can be saved and resumed at any point until the time has expired. The timer will continue to run if you leave the test.
Your answers are saved automatically.

QUESTION 1**8 points**[Save Answer](#)

A rate monotonic scheduler is used to schedule the following tasks, seen in the table below. Assume all times are in milliseconds. What is the completion, turnaround and waiting times for each task and what is the average waiting time?

Task Number	Arrival Time	Execution Time	Deadline	Completion Time	Turnaround Time	Waiting Time
T1	0	1	2			
T2	2	3	5			
T3	6	6	12			
T4	7	8	15			
T5	10	3	11			
T6	15	6	21			
T7	17	3	25			

NOTE: You must use this table to answer the next question.

For the toolbar, press ALT+F10 (PC) or ALT+FN+F10 (Mac).

QUESTION 2

2 points

Save Answer

Using the table in the previous question, what is the Average Throughput in Tasks/s?

For the toolbar, press ALT+F10 (PC) or ALT+FN+F10 (Mac).

QUESTION 3**8 points**[Save Answer](#)

A shortest job first scheduler is used to schedule the following tasks, seen in the table below. Assume all times are in milliseconds. What are the completion, turnaround and waiting times for each task and what is the average waiting time?

Task Number	Arrival Time	Execution Time	Deadline	Completion Time	Turnaround Time	Waiting Time
T1	0	2	4			
T2	2	4	8			
T3	6	1	9			
T4	10	5	15			
T5	12	3	16			
T6	14	6	20			
T7	17	3	21			

NOTE: You must use this table to answer the next question.

For the toolbar, press ALT+F10 (PC) or ALT+FN+F10 (Mac).

QUESTION 4

2 points

Save Answer

Using the table in the previous question, what is the Average Throughput in Tasks/s?

For the toolbar, press ALT+F10 (PC) or ALT+FN+F10 (Mac).

QUESTION 5**10 points**

Save Answer

Consider a file system where disk block addresses are represented by a 32-bit integer. A disk block is 512 bytes long.

Assume that a single command (read or write) to the disk controller consists of a starting disk block address, the number of contiguous blocks to read/write, and the location of the memory buffer for the data. Assume that commands can be sent continuously to the controller (you don't need to wait until the previous one has been serviced unless the next read needs the contents of the previous block). Assume that disk requests are serviced in the order received and with a latency of **5ms** between each request (from the end of the previous data transfer or from the time the command was received, whichever is longer), and a streaming transfer rate of one block per **5µs**.

Now, consider a direct access file currently consisting of the following blocks, listed below, and calculate the requested information for each particular file system below. Assume that CPU operation times can be neglected. Assume that the whole file can fit into memory if needed.

Disk Blocks used for a file:

600, 200, 84, 123, 230, 567, 321, 1000, 1303, 3201, 4567, 1222, 22000, 670, 22800, 33400, 25239, 84607, 120080

For an **Index allocation File System** consider the following assumptions

The file control block is in memory, the file index allocation table is in memory, any new data that needs to be written to the file is in memory. Assume the disk blocks in the file are not contiguous.

Answer the following: Calculate the number of disk controller commands, the number of diskblock I/O operations (i.e. total number of disk block reads and writes), and the total time to complete each of the following operations. **Complete the following table:**

	Number of disk controller commands	Number of disk block I/O operations	Total Time (ms)
i) One block is added to the end of the file.			
ii) One block is added to the beginning of the file.			
iii) Data in location 3000 (bytes from top of file) is altered.			
iv) One block is removed from the end of the file			
v) Block 1222 is removed from the file.			

For the toolbar, press ALT+F10 (PC) or ALT+FN+F10 (Mac).

QUESTION 6**10 points**[Save Answer](#)

Consider a file system where disk block addresses are represented by a 32-bit integer. A disk block is 1024 bytes long.

Assume that a single command (read or write) to the disk controller consists of a starting disk block address, the number of contiguous blocks to read/write, and the location of the memory buffer for the data. Assume that commands can be sent continuously to the controller (you don't need to wait until the previous one has been serviced unless the next read needs the contents of the previous block). Assume that disk requests are serviced in the order received and with a latency of **15ms** between each request (from the end of the previous data transfer or from the time the command was received, whichever is longer), and a streaming transfer rate of one block per **2μs**.

Now, consider a direct access file currently consisting of the following blocks, listed below, and calculate the requested information for each particular file system below. Assume that CPU operation times can be neglected. Assume that the whole file can fit into memory if needed.

Disk Blocks used for a file:

650, 260, 834, 23, 30, 5607, 3201, 1020, 2303, 321, 567, 12220, 2200, 6700, 2280, 3400, 5239, 8607, 14000

For a **Linked File System** consider the following assumptions

The file control block is in memory, the file index allocation table is in memory, each file block contains a link to the next file block, any new data that needs to be written to the file is in memory. Assume the disk blocks in the file are not contiguous.

Answer the following: Calculate the number of disk controller commands, the number of diskblock I/O operations (i.e. total number of disk block reads and writes), and the total time to complete each of the following operations. **Complete the following table:**

	Number of disk controller commands	Number of disk block I/O operations	Total Time (ms)
i) One block is added to the end of the file.			
ii) One block is added to the beginning of the file.			
iii) Data in location 100 (bytes from top of file) is altered.			
iv) One block is removed from the end of the file			
v) Block 6700 is removed from the file.			

For the toolbar, press ALT+F10 (PC) or ALT+FN+F10 (Mac).

QUESTION 7

8 points

Save Answer

Consider a process that requires the following pages from memory:

8,1,2,2,0,4,4,5,6,3,1,3,0,3,3,7,2,0,1,8,0,1

Calculate the number of page faults generated using an Optimal page replacement algorithm for the following frame buffer sizes

- i) two frame buffer
- ii) four frame buffer
- iii) five frame buffer
- iv) seven. frame buffer

For the toolbar, press ALT+F10 (PC) or ALT+FN+F10 (Mac).

QUESTION 8**2 points**[Save Answer](#)

What is CPU device emulation and describe a user case?
For the toolbar, press ALT+F10 (PC) or ALT+FN+F10 (Mac).

QUESTION 9**2 points**[Save Answer](#)

What two modes does a Virtual Machine require?
For the toolbar, press ALT+F10 (PC) or ALT+FN+F10 (Mac).

QUESTION 10**2 points**[Save Answer](#)

What is an advantage and disadvantage of using virtualisation?

For the toolbar, press ALT+F10 (PC) or ALT+FN+F10 (Mac).

QUESTION 11**2 points**[Save Answer](#)

What does a Virtual Machine Manager (VMM) do?

For the toolbar, press ALT+F10 (PC) or ALT+FN+F10 (Mac).

QUESTION 12**2 points**[Save Answer](#)

What is a type 2 Hypervisor and give an example?
For the toolbar, press ALT+F10 (PC) or ALT+FN+F10 (Mac).

QUESTION 13**2 points**[Save Answer](#)

What happens if code running in a virtual machine triggers a trap?
For the toolbar, press ALT+F10 (PC) or ALT+FN+F10 (Mac).

QUESTION 14**2 points**[Save Answer](#)

Regarding synchronisation, what is spinlock?

For the toolbar, press ALT+F10 (PC) or ALT+FN+F10 (Mac).

QUESTION 15**2 points**[Save Answer](#)

Regarding synchronisation, what does starvation mean?

For the toolbar, press ALT+F10 (PC) or ALT+FN+F10 (Mac).

QUESTION 16**2 points**[Save Answer](#)

Regarding synchronisation, what does priority inversion mean?

For the toolbar, press ALT+F10 (PC) or ALT+FN+F10 (Mac).

QUESTION 17

2 points

Save Answer

Consider the following pseduo code below. What do the flag and turn variables do?

```
while (true) {  
    flag[i] = true;  
    turn = j;  
    while (flag[j] && turn == j);  
    critical_section{}  
    flag[i] = false;  
    remainder_section{}  
}
```

For the toolbar, press ALT+F10 (PC) or ALT+FN+F10 (Mac).

QUESTION 18**2 points**[Save Answer](#)

What is the difference between a semaphore and a monitor?
For the toolbar, press ALT+F10 (PC) or ALT+FN+F10 (Mac).

QUESTION 19**2 points**[Save Answer](#)

Give the monitor variable "my_x" - show how a process can allow other processes to resume operating on "my_x".
For the toolbar, press ALT+F10 (PC) or ALT+FN+F10 (Mac).

QUESTION 20**2 points**[Save Answer](#)

Describe two types of semaphores and how they can be used.

For the toolbar, press ALT+F10 (PC) or ALT+FN+F10 (Mac).

QUESTION 21**2 points**[Save Answer](#)

Give the monitor variable "my_x" - show how a process can wait for "my_x" to be available.

For the toolbar, press ALT+F10 (PC) or ALT+FN+F10 (Mac).

QUESTION 22**2 points**[Save Answer](#)

Describe what deadlock in synchronisation will do?
For the toolbar, press ALT+F10 (PC) or ALT+FN+F10 (Mac).

QUESTION 23**2 points**[Save Answer](#)

What is locking in synchronisation used for?
For the toolbar, press ALT+F10 (PC) or ALT+FN+F10 (Mac).

QUESTION 24**2 points**[Save Answer](#)

In regards to deadlocks, what describes a resource that can only be released by a process?

For the toolbar, press ALT+F10 (PC) or ALT+FN+F10 (Mac).

QUESTION 25**2 points**[Save Answer](#)

List three different resource types that may be requested by processes.

For the toolbar, press ALT+F10 (PC) or ALT+FN+F10 (Mac).

QUESTION 26**2 points**[Save Answer](#)

What are three things that a process must do with a resource?

For the toolbar, press ALT+F10 (PC) or ALT+FN+F10 (Mac).

QUESTION 27**2 points**[Save Answer](#)

How does preemption prevent deadlocks?

For the toolbar, press ALT+F10 (PC) or ALT+FN+F10 (Mac).

QUESTION 28**2 points**[Save Answer](#)

What four conditions cause deadlock?

For the toolbar, press ALT+F10 (PC) or ALT+FN+F10 (Mac).

QUESTION 29**2 points**[Save Answer](#)

List three types of IO devices.

For the toolbar, press ALT+F10 (PC) or ALT+FN+F10 (Mac).

QUESTION 30**2 points**[Save Answer](#)

What interface mechanism is used for a synchronous device?

For the toolbar, press ALT+F10 (PC) or ALT+FN+F10 (Mac).

QUESTION 31**2 points**[Save Answer](#)

What interface mechanism is used for a asynchronous device?

For the toolbar, press ALT+F10 (PC) or ALT+FN+F10 (Mac).

QUESTION 32**2 points**[Save Answer](#)

What is an exception?

For the toolbar, press ALT+F10 (PC) or ALT+FN+F10 (Mac).

QUESTION 33**2 points**[Save Answer](#)

What are two ways an IO device can be accessed via an address?

For the toolbar, press ALT+F10 (PC) or ALT+FN+F10 (Mac).

QUESTION 34

5 points

Save Answer

You have been asked to design an operating system for a camera and microphone streaming system called Mooz, that's used for video conferencing.

The system must be able to a user to view and stream their camera and microphone data. A system also allows for chatting via text input.

The system must minimise video and audio latency.

If a multicore processor system is used, what sort of processor affinity should be used for particular tasks? Answer the following.

(i) Suggested solution

(ii) Less favoured alternative

(iii) Two advantages of suggested solution

NOTE: You must use this application to answer the next 3 questions.

For the toolbar, press ALT+F10 (PC) or ALT+FN+F10 (Mac).

QUESTION 35

5 points

Save Answer

For the application in the previous question, choose a Memory Page/Fault Replacement Implementation and list the following:

- (i) Suggested solution
- (ii) Less favoured alternative
- (iii) Two advantages of suggested solution

For the toolbar, press ALT+F10 (PC) or ALT+FN+F10 (Mac).

QUESTION 36

5 points

Save Answer

For the application in the previous question, choose a Process scheduling algorithm and list the following:

- (i) Suggested solution
- (ii) Less favoured alternative
- (iii) Two advantages of suggested solution

For the toolbar, press ALT+F10 (PC) or ALT+FN+F10 (Mac).

QUESTION 37**5 points**[Save Answer](#)

For the application in the previous question, choose a File System Implementation and list the following:

- (i) Suggested solution
- (ii) Less favoured alternative
- (iii) Two advantages of suggested solution

For the toolbar, press ALT+F10 (PC) or ALT+FN+F10 (Mac).

QUESTION 38**0 points**[Save Answer](#)

Please use this space to specify any assumptions you have made in completing the exam and which questions those assumptions relate to. You may also include queries you may have made with respect to a particular question, should you have been able to 'raise your hand' in an examination room.

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