The Open University of Sri Lanka
B.Sc. Degree Programme: LEVEL 04/05
Department of Computer Science
Final Examination 2023/2024
CSU4300 / CSU5315 – OPERATING SYSTEMS
DURATION: Two Hours (2 hours)

Date: 13/12/2024	Time: 9.30 am – 11.30 am

Answer **FOUR** Questions **Only**

QUESTION 1

1.1) What is a *kernel* in an operating system ? List two (2) types of kernels.

1.2) List services provided by *programmer's view* of an opearating system.

1.3) Explain *dispatch, timer runout, block and wakeup* operatons in process state transition of an operating system.

1.4) There can be several operations associated with a process of an operating system. List eight (8) of those operations.

1.5) A disk has 20 tracks in it. Tracks are numbered from 1 to 20 from the track near the spindle of the disk. Seek time across tracks is calculated according to the formula $3n+2$ ms where n is the track number. The disk has 600MB file stored and data is equally distributed across tracks. Assume 1 seek and additional 50ms is needed to read 30 MB of data after seeking to the location of data. Calculate time required to read entire 600MB file from the said disk.

QUESTION 2

2.1) What is the multiprogramming concept in a modern operating system?.

2.2) Consider a system with one CPU and six jobs, Each job has arrival time and burst time as given below.

Job	Arrival Time	Burst Time
1	0	7
2	2	3
3	3	2
4	6	1
5	9	4
6	10	2

(i) Draw separate Gantt charts illustrating the above jobs using **Non pre-emptive SJF, Pre-emptive SJF and Round Robin (time quanta = 2)** scheduling algorithms.

(ii) Compute the *average turn around time, average waiting time* and *average response time* for above jobs using **pre-emptive SJF algorithm**. Show all the calculations.

(iii) What happens to Round robin algorithm when time quanta is infinite?

QUESTION 3

3.1) What is *race condition* in an operating system ? explain with an example.

3.2) List conditions required to achieve *mutual exclusion* as an solution to race codition.

3.3) What are the four (4) basic events that cause a process to be created?

3.4) List differences between *kernal level threads* and *user level threads*.

3.5) Matrix A(12x3) and matrix B(3x8) need to be multiplied using a 4 core CPU supporting 2 threads per core. Assuming 3ms is needed per multiplication operation, calculate the time required in miliseconds to do the entire matrix multiplication.

QUESTION 4

4.1) What are the disadvantages of *memory compacting operation* in memory management?

4.2) List **two** (2) free memory management schemes.

4.3) Suppose you have the following page reference string and the frames (0,1,2).

Reference string	2	2	3	4	2	4	3	1	2	1	4	6	5	6	7	5
Frame 0																
Frame 1																
Frame 2																

Use the table above to show frame allocation using the FIFO algorithm. Mark the frame replacement locations using *. (Hint: draw this table in your answer script and fill the blanks)

4.4) Assume that the operating system on your computer uses the buddy system for memory management. Initially the system has 8192 KB of memory, which begins at address 0. Show the result of each request/release given below via successive figures.

1. A: Request 650KB
2. B: Request 400KB
3. C: Request 225KB
4. D: Request 140KB
5. Release A
6. E: Request 240KB
7. Release B

8. F: Request 120 KB
9. Release C
10. Release D
11. Release E
12. Release F

4.5) Assuming that the system given in above question 4.4 has only completed up to the memory request of E, compute the amount of internal fragmentation that exists in the system at that time.

QUESTION 5

5.1)   Why memory bound registers are implemented in an operating system?

5.2)   Explain functionality of an overlay structured program.

5.3)   List **four** (4) necessary conditions for a deadlock to occur.

5.4)   In a system, there is a total of 26 units of resource R1, 18 units of resource R2 and 13 units of resource R3. The system is in the following state (S0).

Process	Max			Allocation		
	R1	R2	R3	R1	R2	R3
P0	6	7	4	4	2	3
P1	12	10	5	6	7	4
P2	7	8	4	5	4	1
P3	10	5	3	6	3	2

(i)   Show that the above state (S0) is a safe state. Give the complete sequence of jobs.

(ii)   The process P1 requests for the resources (R1, R2, R3) equivalent to units (1, 0, 1) when the system is in state S0. Is it possible to grant the request by P1? Give the process sequence.

QUESTION 6

6.1)   Permission numbers of files fathima.txt and janaka.txt are given as 631, 754 respectively.

(i) Explain the permissions of those files in terms of owner, group and others.

(ii) Which file has the most permissions for the owner ?

6.2)   Draw a diagram to show *Indexed allocation* of a disk space using an example.

6.3)   What are the four (4) steps used in transfer of each byte under the transfer mode programmed input output (PIO).

6.4)   Draw diagrams to describe the functionality of the following disk access scheduling schemes in a disk having 0-999 cylinders. Previous and current head positions are 200 and 250 respectively. The read request sequence is 300, 250, 500, 45, 185, 615, 700. Then calculate the distance traveled by disk head in each of the scheduling algorithm given below from the current head position.

(i)   C-SCAN
(ii) C-LOOK
(iii) LOOK
(iv) SSTF

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