

**COMSATS UNIVERSITY ISLAMABAD (CUI)**

DEPARTMENT OF COMPUTER SCIENCE
 TERMINAL EXAMINATION FALL - 2022
 BS (AI,DS,CT) SEMESTER

Course: CSC322-Operating Systems**Instructor:** Zahida Walayat**Maximum Marks:** 50**Dated:** January 18, 2023**Time Allowed:** 180 Minutes

- All questions are self-explanatory and require no further explanations during exam time.
- Make sure that you have signed the attendance sheet before leaving the examination room.
- Return the question paper along with the answer sheet.
- Attempt all questions.

(CLO- 2: Analyze various operations performed by operating system for process management)**Question # 1:**

Q# 1.1: A vehicle manufacturing company wants to automate its assembly plant. The requirement analysis has been carried out. There are a total of 500 processes that will be executed on 50 separate single-processor systems. Each system consists of a CPU, RAM, bus-system, hard-disk, terminal (optional) and required I/O devices. The workload is well-defined, and all of the requirements of processes (CPU time and other resources) are known a-priori.

Suppose you have to design an OS for this system, then answer the following:

- Is it beneficial to add support for multithreading to get speed up? (1)
- What modifications are required if we use SJF algorithm for process scheduling? (1)
- Can we use deadlock avoidance in this system, if yes then which algorithm is the best? (1)
- Which data structures will be required to save the process and system state? (2)

Q# 1.2: Ali is given the job to write a program that will get a speedup of 3.8 on 4 processors. He makes it 90% parallel. Assuming the problem size is the same as the serial version, and ignoring communication costs, what speedup will Ali actually get? (2)

1.3: Suppose the scheduling algorithm in an OS uses RR and Preemptive SJF algorithms combined in such a way that for first 40ms RR algorithm (with $Q=5$) is used and then for next 30ms Preemptive SJF is used; and it goes on in the same way. At time instant when algorithm is changed the currently executing process is stopped and next process is selected using the new algorithm. Considering this algorithm, show the execution of following set of processes using the Gantt chart. (7)

Process	P1	P2	P3	P4	P5	P6	P7	P8	P9
Arrival Time (ms)	6	0	14	19	39	44	47	48	49
Burst Time (ms)	15	18	20	12	10	6	5	6	4

4: Assume that an application consists of the three processes (code is given below). Using semaphore, add the code to ensure that S2 is executed first, then S3 and in the end S1 is executed. (3)

P1	P2	P3
<pre>int main() { cout<<"Welcome"<<endl; S1; return 0; }</pre>	<pre>int main() { cout<<"Welcome"<<endl; S2; return 0; }</pre>	<pre>int main() { cout<<"Welcome"<<endl; S3; return 0; }</pre>

Suppose in a computer system there are five resource types: printer, hard-disk, Memory, CPU and Terminal. Currently, there are five processes (P1, P2, P3, P4, P5). The current system state is as: P1 has hard-disk and needs

the printer, P2 has the printer while it needs Memory, CPU and Terminal, P3 has CPU and it needs the terminal. P4 has terminal and it needs hard disk, while P5 has Memory, and it does not require any more resource. Considering this system state find whether the system is in deadlock state or not. If yes, then suggest a recovery scheme. (5)

(CLO- 3: Analyze the memory management issues and techniques in the context of operating system.)

Question #2:

Q# 2.1: Differentiate internal and external fragmentation. (2)

Q# 2.2: In an OS paging is used for memory management. The total memory installed is 64 bytes, and frame size is 4 bytes. The maximum size of the process that can run on this machine is 32 bytes. Currently, the following free frames are available: 2, 4, 12, 13, 5, 14, 15, and 8. A P1 program consists of the following string: ABCDEF GH IJK LMN (total 17 characters including spaces).

- What would be the minimum length of logical and physical addresses? (2)
- Allocate memory to the program P1 (draw a diagram showing the allocation) and write the page table (3)
- Write logical address of characters G, K, L and N (2)
- Convert the logical addresses into physical addresses for the character G, K, L and N (2)
- What is the total amount of internal fragmentation? (1)

Q# 2.3: Suppose pure-demand paging is implemented in an OS for managing memory. A process P1; consisting of 10 pages access the pages in the following sequence

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

Count the page fault if the following algorithms are used for page replacement: LRU (with stack) and second-chance. (Assume quota of frames is 4). (6)

(CLO- 4: State the concepts of file system, storage and security issues.)

Question #3:

Q# 3.1: Suppose that a disk drive has 4,000 cylinders, numbered 0 to 3,999. The drive is currently serving a request at cylinder 950, and the previous request was at cylinder 765. The queue of pending requests, in FIFO order, is:

1069, 980, 1296, 640, 544, 339, 356, 1523, 3465, 3681

Starting from the current head position, what is the total distance (in cylinders) that the disk arm moves to satisfy all the pending requests for each of the following disk-scheduling algorithms? (5)

- SSTF
- FCFS

Q# 3.2: Explain the basic program threats to a computer system and the common security techniques that can be used to guard against these threats? (5)

*****BEST OF LUCK*****