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MAIN EXAMINATION

MAY – AUGUST 2021

FACULTY OF SCIENCE

DEPARTMENT OF COMPUTER AND INFORMATION SCIENCE

REGULAR PROGRAMME

CMT 206: OPERATING SYSTEMS

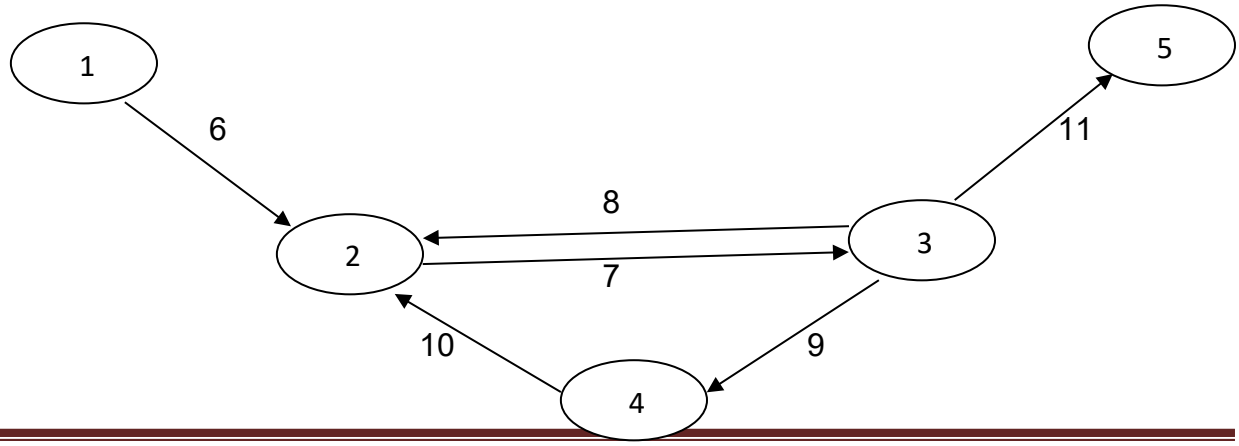
Date: AUGUST 2021	**Duration: 2 Hours**
Instructions: Answer Question ONE and any other TWO Question.	

1. a) Distinguish the following terms:
   - i) Process and thread (**2 marks)**
   - ii) Pre-emptive and non-preemptive scheduling (**2 marks)**
   - iii) External and internal fragmentation (**2 marks**)
   - iv) Logical and physical address **(2 marks**)

b) List any five functions of an operating system. (**5 marks**)

c) What is a critical section problem? **(2 marks)**

d) Below there is a diagram of process states and transitions between them. Fill in the entries 1 – 11. (5 marks)



e) List the four conditions under which a deadlock situation may arise. (**4 marks**)

f) Define the three conditions that must be satisfied for a critical section problem to be solved. (**6 marks**)

2. a) Five processes A, B, C, D and E arrived in this order at the same time with the following CPU burst and priority values. A smaller value means higher priority.

Process	CPU Burst	Priority
A	4	2
B	6	4
C	2	1
D	5	3
E	3	5

Fill the waiting waiting scheduling process. overhead. entries of the table with time and average time for each indicated policy and each Ignore context switching (**16 marks**)

	Waiting Time					Average
	A	B	C	D	E	Waiting Time
Scheduling Policy						
First Come First Served						
Non-preemptive Shortest Job First						
Priority						
Round-Robin (quantum = 2)						

b) Name the following items:

i) The ability of multiple processes to coordinate their activities by exchange of information. (**1 mark)**

ii) A scheduler that determines when new processes are admitted to the system. **(1 mark)**

iii) The ability of an operating system to support multiple, concurrent paths of execution within a single process. **(1 mark)**
iv) A situation in which a process is ready to execute but is continuously denied access to a processor in deference to other processes. **(1 mark**)

3. a) Consider the following page reference string:
1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6
How many page faults would occur with 5 empty page frames using the following page replacement algorithms?

i) Least Recently Used (**4 marks)**
ii) First-In First-Out (**4 marks)**
iii) Optimal (**4 marks)**

b) Name two differences between logical and physical address. (**2 marks**)

c) Consider a logical address space of 8 pages mapped onto a physical memory of 32 frames. Given that the frame size is 1024 bytes, calculate:

i) How many bits are needed for the page number? (**2 marks**)
ii) How many bits are required for the offset? (**2 marks**)
iii) How many bits are there in the logical address? (**2 marks)**

4. a) Consider the following snapshot of a system.

	Allocation				Max				Need				Available			
	U	V	W	X	U	V	W	X	U	V	W	X	U	V	W	X
A	0	0	1	4	1	2	4	4	1	1	2	0	0	1	1	0
B	1	1	2	0	1	2	3	0	0	1	1	0				
C	1	3	0	0	4	3	0	0	3	0	0	0				
D	2	0	1	0	4	6	6	2	2	2	5	2				

E	1	3	2	6	1	4	6	9	0	1	4	3			

i) Using Banker's algorithm, calculate the steps to find a safe sequence**.(8marks**)
ii) Is this system in a safe state? (Show the sequence) **(2 marks**)

b) A system has five processes P1 to P5 and four resource types R1 to R4. There are 2 units of each resource type. Given that:
P1 holds 1 unit of R1 and requests 1 unit of R4
P2 holds 1 unit of R3 and requests 1 unit of R2
P3 holds 1 unit of R2 and requests 1 unit of R4
P4 holds 1 unit of R4
P5 holds 1 unit of R3 and 1 unit of R2 and requests 1 unit of R3

i) Show the resource graph for this state of the system. (**8 marks)**
ii) Is the system in deadlock and if so which processes are involved. **(2 marks**)

5. a) Assume that the list of holes in a variable partition memory system contains the following entries (in the given order) 190KB, 550KB, 220KB, 420KB, 650KB, 110KB. Consider the following sequence of requests: A = 210KB, B =430KB, C = 100KB, D = 420KB
Determine which holes would be allocated to which request by each of the following schemes:

i) First- Fit **(2 marks)**
ii) Next-Fit (**2 marks**)
iii) Best-Fit (**2 marks**)
iv) Worst-Fit (**2 marks**)

b) Briefly describe four benefits of threading. **(4 marks**)
c) In the context of multicore programming, what is the difference between parallelism and concurrency? (**2 marks**)
d) Identify the two models used in interprocess communication. **(2 marks**)
e) Name four benefits of process cooperation**.** **(4 marks)**