

AMIETE – CS (OLD SCHEME)

Code: AC13
Time: 3 Hours

Subject: OPERATING SYSTEMS
Max. Marks: 100

DECEMBER 2010

NOTE: There are 9 Questions in all.

- Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.
- The answer sheet for the Q.1 will be collected by the invigilator after half an hour of the commencement of the examination.
- Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.
- Any required data not explicitly given, may be suitably assumed and stated.

Q.1 Choose the correct or the best alternative in the following: (2 × 10)

a. To prevent signals from colliding on the bus, _____ prioritize(s) access to memory by I/O channels and processors.

- (A) a register (B) interrupts
(C) the processor scheduler (D) a controller

b. Which of the following state is not a discrete process state?

- (A) *running* state (B) *blocked* state
(C) *ready* state (D) *unblocked* state

c. An unsafe state implies _____.

- (A) the existence of deadlock
(B) that deadlock will eventually occur
(C) that some unfortunate sequence of events might lead to a deadlock
(D) none of the above

d. A _____ can be used in single-user contiguous memory allocation systems to prevent programs from damaging the operating system's memory.

- (A) lock (B) protection bit
(C) boundary register (D) semaphore

e. Consider a system having ' m ' resources of the same type. These resources are shared by 3 processes A, B, C , which have peak time demands of 3, 4, 6 respectively. The minimum value of ' m ' that ensures that deadlock will never occur is

- (A) 13 (B) 14
(C) 11 (D) 12

f. In paged memory systems, if the page size is increased, then internal fragmentation generally

- (A) become less (B) becomes more
(C) remains constant (D) none of the above

- g. _____ improve system performance by temporarily storing data during _____ between devices or processes that operate at different speeds.
- (A) Caches (B) Controllers
(C) Buffers (D) Registers
- h. If the no of pages in a 32 bit machine is 8kB then what is the size of the page table?
- (A) 8 KB (B) 16 KB
(C) 4 KB (D) none of the above
- i. If the total number of available frames is 50, and there are 2 processes one of 10 pages and the other of 5 pages then how much of memory would be proportionally allocated to each of these processes?
- (A) Depends on the process requirements
(B) 33 and 16 frames respectively
(C) Memory is allocated equally for both
(D) 5 and 10 respectively
- j. Assume a page reference string for a process with m frames (initially all empty). The page reference string has length p with n distinct page numbers occurring in it. For any page-replacement algorithms, what is a lower bound & an upper bound on the number of page faults?
- (A) $n/2, p$ (B) p, n
(C) $n, p/2$ (D) n, p

**Answer any FIVE Questions out of EIGHT Questions.
Each question carries 16 marks.**

- Q.2** a. What is an Operating System ? Explain the *four* types of operating systems categorized based on the types of computers it control and the sort of applications it supports (8)
- b. Give two reasons why caches are useful. What problems do they solve? What problems do they cause? If a cache can be made as large as the device for which it is caching (for instance, a cache as large as a disk), why not make it that large and eliminate the device? (4)
- c. How does the distinction between monitor mode and user mode function as a basic form of protection system in Operating System? (2)
- d. What are the differences between a trap and an interrupt? (2)
- Q.3** a. Explain services provided by an operating system and how each provides convenience to the users. Explain also in which cases it would be impossible for user-level programs to provide these services. (8)

- b. What are the differences between the shared memory and message passing process communications? (4)
- c. What happens on a context switch? Should context switches happen frequently or infrequently? Explain your answer (4)

Q.4

- a. What resources are used when a thread is created? How do they differ from those used when a process is created? (4)
- b. Consider the following jobs 0 to 4. Given the job lengths, and arrival times, assume a time slice of 15 and compute the completion and average response time of each job for the FIFO, RR, and SRTF algorithms. (12)

Job	Length	Arrival Time
0	75	0
1	40	10
2	25	10
3	20	80
4	45	85

- Q.5** a. A father and his *three* sons work in a restaurant that makes vegetable sandwich. Making a sandwich requires three ingredients: bread, boiled vegetables, and cheese. One Son has an infinite supply of bread, another has an infinite supply of boiled vegetables, and a third has an infinite supply of cheese.

Sandwiches are made as follows: The father first places a pan on the counter. The son with the bread places it on the pan, then the second son spreads vegetables on the bread and finally the third son adds cheese. When the third son is done, the father puts the sandwich in the oven and then starts the next sandwich. Write code for the father and a general procedure that can be used for any son, making sure that the father and sons are synchronized properly with semaphores. (8)

- b. Consider the following table, with resources A, B, C, and D, and processes P₀ to P₄ and Using Banker's algorithm answer the following questions. (8)

	Allocation				Max				Available				Need			
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
									3	2	1	0				
P ₀	3	0	0	2	6	0	1	2					3	0	1	0
P ₁	1	0	0	0	1	7	5	0					0	7	5	0
P ₂	1	3	5	4	2	3	5	6					1	0	0	2
P ₃	0	6	3	2	1	6	5	2					1	0	2	0
P ₄	0	0	1	4	1	6	5	6					1	6	4	2

- (i) Is the system in a safe state? Why?

(ii) If a request from process P_4 arrives for additional resources of $(1,2,2)$ can the Banker's algorithm grant the request immediately? Show the new system state, and other criteria.

- Q.6**
- Define fragmentation. Differentiate between external fragmentation & internal fragmentation. (6)
 - You find a computer that uses demand-paged virtual memory, with the page table stored in main memory. You measure the following characteristics: (10)
 - servicing a page fault takes 5ms if the replaced page is unmodified, 10ms if it is modified,
 - when pages are replaced, they are modified 20% of the time,
 - accessing main memory takes 200ns, and the hit rate for main memory is 97%.

What is the effective memory access time for this system? You add a TLB to the above system, which has an access time of 10ns and a hit rate of 95%. What is the new effective memory access time?

- Q.7**
- Given memory partitions of 100K, 500K, 200K, 300K, and 600K (in order), how would each of the First-fit, Best-fit, and Worst-fit algorithms place processes of 212K, 417K, 112K, and 426K (in order)? (8)
 - Consider the following page request sequence ; 4 2 4 5 3 5 2 3 4 2 3 5 3 4 2 4. Calculate the page fault while using the following page replacement policy (1) First in First out (2) Least Recently used (3) Least Frequently Used. Assume frame size of 3 and No frames pre-loaded (8)

- Q.8**
- What is root file system? What is inode in UNIX? (5)
 - Give an example of an application in which data in a file should be accessed in
 - Sequentially and
 - randomly
 (3)
 - Consider a system that supports 8000 users. Suppose that you want to allow 6600 of these users to be able to access one file. How would you specify this protection scheme in UNIX? (4)
 - Explain various file allocation methods (4)

- Q.9**
- Explain why SSTF scheduling tends to favor middle cylinders over the innermost and outermost cylinders. (4)
 - What are the advantages and disadvantages of using DMA? (3)
 - What do you mean by domain of protection? (3)
 - Present an election algorithm for reconstructing a logical ring after a ring failure. (6)