BITS, PILANI – DUBAI CAMPUS
KNOWLEDGE VILLAGE, DUBAI
III Year First Semester 2005 – 2006
OPERATING SYSTEMS CS UC 372
Comprehensive Examination (Closed Book)

Time : 3 hours **Weightage : 40%**
05.01.06 **MAX : 40 MARKS**

Answer all the questions

1. Explain the technique for overcoming external fragmentation. (1 mark)
2. What is principle of locality? (1 mark)
3. What is the need for modify bit in page table? (1 mark)
4. Define rotational delay. (1 mark)
5. Define inode. (1 mark)
6. Distinguish between simple paging and virtual memory paging. (1 mark)
7. Distinguish between programmed I/O and interrupt driven I/O. (1 mark)
8. Explain indexed file organization with diagram. (2 marks)
9. What are the conditions for deadlock? Define them. (2 marks)
10. Explain clock replacement algorithm with an example. (2 marks)
11. Distinguish between logical and physical address. (1 mark)
12. What are the three methods of record blocking? (1 mark)

13. A 1MByte block of memory is allocated using the buddy system.

    a. Show the results of the following sequence in a diagram Request 70K, Request 35K, Request 80K, Return A, Request 60K, Return B, Return D, Return C. (3 marks)
    b. Show the binary tree representation (1 mark)

14. Given memory partitions of 100KB, 500KB, 200KB, 300KB and 600KB (in order), how would each of the first-fit and best- fit algorithms place processes of 212 KB, 417 KB,112 KB and 426 KB (in order)? Which algorithm makes the most efficient use of memory? (3 marks)

15. Consider the following page-reference string:

    7,0,1,2,0,3,0,4,2,3,0,3,2,1,2,0,1,7,0,1

    How many page faults would occur for the following replacement algorithms if there are three frames? Show clearly when each page fault would occur. (3 marks)

    a. FIFO
    b. LRU
    c. Optimal

16. Consider a disk queue with requests for I/O to blocks on cylinders
98,183,37,122,14,124,65,67
In that order. If the disk head is initially at cylinder 53, Find the average seek length and the number of tracks traversed for the following algorithms. Also draw the graph for disk movement. For each algorithm give the order in which the tracks will be accessed. (4 marks)

a. FIFO
b. SSTF
c. SCAN
d. C-SCAN

17. In the segment table given below, base is the beginning address of the segment in physical memory and limit is the length of the segment.

a. A reference to byte 53 of segment 2 is mapped onto location _____(1mark)
b. A reference to byte 852 of segment 3 is mapped onto location _____ (1 mark)

Segment no	Limit	Base
0	1000	1400
1	400	6300
2	400	4300
3	1100	3200
4	1000	4700

18. Consider a magnetic disk with average seek time of 15 ms and rotational delay of 3 ms having 512 byte sectors with 320 sectors per track. To read a file consisting of 2560 sectors for a total of 1.3 Mbyte. Estimate the total time for transfer. Assume there are 8 tracks distributed randomly over the disk. Time to read one sector is 0.01875 ms. (2 marks)

19. Consider the following snapshot of a system

	Allocation	Max	Available
	A B C	A B C	A B C
P0	0 1 0	7 5 3	3 3 2
P1	2 0 0	3 2 2	
P2	3 0 2	9 0 2	
P3	2 1 1	2 2 2	
P4	0 0 2	4 3 3	

Answer the following questions using the banker's algorithm

a. What is the content of the matrix Need ? (1 mark)

b. Is the system in a safe state? Give the safe sequence. Show the detailed working of the algorithm. (2 marks)

c. If a request from process P1 arrives for (1,0,2) can the request be granted immediately. What will be the state of the system? (1 mark)

d. After considering the request of P1 if a request from P4 arrives for (3,3,0) can it be granted? What will be the state of the system? (1 mark)

20. Apply deadlock detection algorithm to the following system which has 5 processes P0 through P4 and has three resource types A,B,C .Resource type A has 7 instances, Resource type B has 2 instances, Resource type C has 6 instances.

Avail = 0 0 0

Alloc	Request
0 1 0	0 0 0
2 0 0	2 0 2
3 0 3	0 0 0
2 1 1	1 0 0
0 0 2	0 0 2

a. Is the system is in deadlock state? Give the safe sequence. (1 mark)

b. If P2 makes an additional request for an instance of type C what will be the state of the system? (1 mark)

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Make up
TEST – II (Open Book)

Time : 50 minutes **Weightage : 20%**
05.12.05 **MAX : 20 MARKS**

1. Consider a system consisting of *m* resources of the same type, being shared by *n* processes. Resources can be requested and released by processes only one at a time. Show that the system is deadlock free if the following two conditions hold.
a. The maximum need of each process is between 1 and m resources.
b. The sum of all maximum needs is less than m + n. (3 marks)

2.Consider the following snapshot of a system

	Allocation	Max	Available
	A B C D	A B C D	A B C D
P0	0 0 1 2	0 0 1 2	2 1 0 0
P1	2 0 0 0	2 7 5 0	
P2	0 0 3 4	6 6 5 6	
P3	2 3 5 4	4 3 5 6	
P4	0 3 3 2	0 6 5 2	

Answer the following questions using the banker's algorithm:

a. What is the content of the matrix Need? (2 marks)
b. Is the system in safe state? If yes list the safe sequence. (3 marks)
c. If a request from process P3 arrives for (0,1,0,0) can the request be granted immediately? (3 marks)

3. Consider a system with a total of 120 units of memory, allocated to three processes as shown. (4 marks)

Process	Max	Hold
1	100	50
2	40	20
3	90	20

Apply the banker's algorithm to determine whether it would be safe to grant each of the following requests. If yes, indicate a sequence of terminations that could be guaranteed possible. If no, show the reduction of the resulting allocation table.

a. If the third process requires additional 10 units. What will be the state of the system. Give a detailed answer.

4. Prove the correctness of Peterson's algorithm.

a. Prove that mutual exclusion is enforced. (3 marks)

b. Prove that a process requiring access to its critical section will not be delayed indefinitely. Consider the following cases. (2 marks)

   1. A single process is attempting to enter the critical section
   2. both processes are attempting to enter the critical section

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TEST – II (Open Book)

Time : 50 minutes **Weightage : 20%**
05.12.05 **MAX : 20 MARKS**

1. Consider a system consisting of four resources of the same type that are shared by three processes, each of which needs at most two resources. Will the system be in safe or deadlock state. Explain (3 marks)

2.Consider the following snapshot of a system

	Allocation	Max	Available
	A B C D	A B C D	A B C D
P0	0 0 1 2	0 0 1 2	1 5 2 0
P1	1 0 0 0	1 7 5 0	
P2	1 3 5 4	2 3 5 6	
P3	0 6 3 2	0 6 5 2	
P4	0 0 1 4	0 6 5 6	

Answer the following questions using the banker's algorithm:

a. What is the content of the matrix Need? (2 marks)
b. Is the system in safe state? If yes list the safe sequence. (3 marks)
c. If a request from process P1 arrives for (0,4,2,0) can the request be granted immediately? (3 marks)

3. Consider a system with a total of 150 units of memory, allocated to three processes as shown. (4 marks)

Process	Max	Hold
1	70	45
2	60	40
3	60	15

Apply the banker's algorithm to determine whether it would be safe to grant each of the following requests. If yes, indicate a sequence of terminations that could be guaranteed possible. If no, show the reduction of the resulting allocation table.

a. A fourth process arrives, with a maximum memory need of 60 and an initial need of 25 units.
b. A fourth process arrives, with a maximum memory need of 60 and an initial need of 35 units

4. Prove the correctness of Dekker's algorithm.
a. Prove that mutual exclusion is enforced. (3 marks)
b. Prove that a process requiring access to its critical section will not be delayed indefinitely. Consider the following cases. (2 marks)
    1. A single process is attempting to enter the critical section
    2. both processes are attempting to enter the critical section

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QUIZ –II (Closed Book)
Version - A

Time : 30 minutes **Weightage : 10%**
17.11.05 **MAX : 10 MARKS**

All questions carry equal marks (1/2)

1. When one process is inside critical section and all the other processes attempting to enter their critical section will do _____.
2. Reading and testing in special machine instruction is performed in _____ instruction cycle.
3. _____ operation increments the semaphore value.
4. Semaphore that specifies the order in which processes are removed from queue is _____.
5. _____ provides a mechanism to allow processes to communicate and to synchronize their actions.
6. _____ is a condition that occurs when a set of processes wishes to enter their critical section but no process can succeed.
7. To guarantee mutual exclusion it is sufficient to prevent a process from being _____.
8. When a process is indefinitely denied access to the resource the situation is called as _____.
9. _____ is an example of process interaction where processes are indirectly aware of each other.
10. State true or false
    Sometimes more than one process is allowed inside critical section.

11. _____ is the advantage of having minimal kernel size in microkernel based operating system.

12. _____ is the situation where there are possible sequences of execution that can succeed but it is also possible to describe one or more execution sequences in which no process ever enter its critical section.

13. _____ is the disadvantage of microkernel.

14. _____ is the basic form of communication between processes or threads in a microkernel operating system.

15. The basic requirement for support of concurrent processes is the ability to enforce _____

16. The management of multiple processes within a uniprocessor system is _____

17. State true or false
Micro-kernels can recognize and handle interrupts.

18. Flush operation is used by a process to _____ pages that were granted or mapped to other processes.

19. _____ is the design issue associated with concurrency.

20. _____ is the drawback of software approach to mutual exclusion.

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OPERATING SYSTEMS CS UC 372

QUIZ –II (Closed Book)
Version - B

Time : 30 minutes **Weightage : 10%**
17.11.05 **MAX : 10 MARKS**

All questions carry equal marks (1/2)

1. _____ is the advantage of having minimal kernel size in microkernel based operating system.

2. _____ is the situation where there are possible sequences of execution that can succeed but it is also possible to describe one or more execution sequences in which no process ever enter its critical section.

3. _____ is the disadvantage of microkernel.

4. _____ is the basic form of communication between processes or threads in a microkernel operating system.

5. The basic requirement for support of concurrent processes is the ability to enforce _____

6. The management of multiple processes within a uniprocessor system is _____

7. State true or false
   Micro-kernels can recognize and handle interrupts.

8. Flush operation is used by a process to _____ pages that were granted or mapped to other processes.

9. _____ is the design issue associated with concurrency.

10. _____ is the drawback of software approach to mutual exclusion.

11. When one process is inside critical section and all the other processes attempting to enter their critical section will do _____.

12. Reading and testing in special machine instruction is performed in _____ instruction cycle.

13. _____ operation increments the semaphore value.

14. Semaphore that specifies the order in which processes are removed from queue is _____.

15. _____ provides a mechanism to allow processes to communicate and to synchronize their actions.

16. _____ is a condition that occurs when a set of processes wishes to enter their critical section but no process can succeed.

17. To guarantee mutual exclusion it is sufficient to prevent a process from being _____.

18. When a process is indefinitely denied access to the resource the situation is called as _____.

19. _____ is an example of process interaction where processes are indirectly aware of each other.

20. State true or false
Sometimes more than one process is allowed inside critical section.

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OPERATING SYSTEMS CS UC 372

TEST – I (Closed Book)

Time : 50 minutes
16.10.05

Weightage : 20%
MAX : 20 MARKS

1. Why it does not make sense to associate suspend state with threads? (1 mark)
2. Define multithreading. (1 mark)
3. State true or false. Explain why? (1 mark)
   If one thread of a process is blocked, it prevents running of other threads in the same process.
4. In a pure kernel level thread, thread management is done by _____ (1/2 mark)
5. Why thread switching does not require kernel mode privileges? (1 mark)
6. Explain with diagram the relationship between thread scheduling and process scheduling (3 marks)
7. Give two examples of the uses of threads in a single user multiprocessing system (1/2 mark)
8. Give two reasons for transition of a process from Running to Ready state. (1 mark)
9. What is swapping and what is its purpose? (1 mark)
10. Why are two modes (user and kernel) needed? How does the processor know in which mode it is to be executing?(2 marks)
11. What is the difference between an interrupt and a trap? (1 mark)
12. Under what conditions the transition Ready to Ready/Suspend take place in a process. Explain with diagram (2 marks)
13. Explain with diagram virtual machines. (3 marks)
14. What the operating system must know to manage and control a process ? (1 mark)
15. Define process image. What are the elements of process image? (1 mark)

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QUIZ – I (Closed Book)
Version - A

Time : 30 minutes
22.09.05

Weightage : 10%
MAX : 10 MARKS

1. What are the 2 main problems in Serial Processing Operating Systems? (1/2 + ½)
2. a. Define privileged instruction. (1/2 mark)
   b. Give an example (1/2 mark)
3. Listing the sequence of instructions that execute for that process is referred to as _____ of the process. (1 mark)
4. When one process spawns another, the former is referred to as _____ process and the spawned process is referred to as the _____ process (1/2 + ½)
5. Why there is a need for multiple event queue? (1 mark)
6. Operating System is a (1 mark)
   a. program in execution
   b. set of instructions
   c. program that controls the execution of application programs and acts as an interface between applications and computer hardware.
   d. program to execute instructions
7. In a simple batch system, it takes 0.0015 seconds to read one record from file and 0.0001 seconds to execute 100 instructions and 0.0015 seconds to write one record to file. Find the percentage CPU utilization. (1 mark)
8. Give 2 advantages of client server model? (1/2 + ½)
9. Define virtual machine. (1 mark)
10. Define timesharing (1 mark)

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OPERATING SYSTEMS CS UC 372

QUIZ – I (Closed Book)
Version – B

Time : 30 minutes
22.09.05

Weightage : 10%
MAX : 10 MARKS

1. Define timesharing (1 mark)
2. Operating System is a (1 mark)
   a. program in execution
   b. set of instructions
   c. program that controls the execution of application programs and acts as an interface between applications and computer hardware.
   d. program to execute instructions
3. When one process spawns another, the former is referred to as _____ process and the spawned process is referred to as the _____ process (1/2 + ½)
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5. Give 2 advantages of client server model? (1/2 + ½)
6. Why there is a need for multiple event queue? (1 mark)
7. What are the 2 main problems in Serial Processing Operating Systems? (1/2 + ½)
8. a. Define privileged instruction. (1/2 mark)
   b. Give an example (1/2 mark)
9. Listing the sequence of instructions that execute for that process is referred to as _____ of the process. (1 mark)
10. Define virtual machine (1 mark)