King Saud University

College of Computer and Information Sciences
Computer Science Department

Course Code:	CSC 227
Course Title:	Operating Systems
Semester:	Spring 2015
Exercises Cover Sheet:	**Mid 2 Exam**

Duration: 90 min

Student Name:	
Student ID:	
Student Section No.	

Tick the Relevant	Computer Science B.Sc. Program ABET Student Outcomes	Question No. Relevant Is Hyperlinked	Covering %
	a) Apply knowledge of computing and mathematics appropriate to the discipline;		
	b) Analyze a problem, and identify and define the computing requirements appropriate to its solution		
	c) Design, implement and evaluate a computer-based system, process, component, or program to meet desired needs;		
	d) Function effectively on teams to accomplish a common goal;		
	e) Understanding of professional, ethical, legal, security, and social issues and responsibilities;		
	f) Communicate effectively with a range of audiences;		
	g) Analyze the local and global impact of computing on individuals, organizations and society;		
	h) Recognition of the need for, and an ability to engage in, continuing professional development;		
	i) Use current techniques, skills, and tools necessary for computing practices.		
	j) Apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices;		
	k) Apply design and development principles in the construction of software systems of varying complexity;		

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CSC 227: Operating Systems

Total Marks: 25 **Time: 7:00pm – 8:30pm (90 minutes)**
Spring 2015-16 **Name:** ……
Midterm Exam II **ID#:** ……
Date: 19-April-2016 **Section#:**…… **or Teacher Name**: ……

Instructions:

- This exam has 6 pages including the title page.
- Do not use pencil.
- Write clearly and neatly.

Question 1. [10 marks] Select ONLY ONE ANSWER (the best answer).
Copy your answer for question 1-1 to 1-15 in the table on page2. ONLY THAT TABLE WILL BE GRADED.

1.	The fork system call returns …….. for the child process:
a.	The PID of the parent
b.	-1
c.	0
d.	1

2.	Which of the following component is NOT shared among different threads of the same process:
a.	code
b.	registers
c.	data
d.	files

3.	If a thread invokes the exec() system call:
a.	It will replace the entire process including all threads
b.	It creates a new process with new threads
d.	It copies existing process
f.	It will rename the existing process

4.	Which of the following state is shared between the parent process and the child process?
a.	Stack
c.	Heap
e.	Shared memory segments
g.	All the above

5.	In a deferred cancellation mode what will happen to the thread?
a.	It will be cancelled immediately
b.	It will continue running until it arrives to cancellation point
c.	It can ignore the cancellation request and continue running to its end
d.	It will be put in the waiting queue until it receives a new signal

6.	Two types of semaphores are:
a.	adding Semaphores and Binary Semaphores
b.	analog Semaphores and Octal Semaphores
c.	counting Semaphores and Binary Semaphores
d.	critical Semaphores and System Semaphores

7.	Parent may terminate the execution of children processes because of:
a.	the child has exceeded allocated resources
b.	the task assigned to child is no longer required
c.	the parent is exiting and the OS does not allow a child to continue if its parent terminates
d.	any of the above reasons.

8.	Semaphore can be used for solving:
a.	Wait & signal
b.	Deadlock
c.	Priority
d.	Synchronization

9.	Which of the following is not used for synchronization?
a.	Peterson's Solution
b.	Bankers' algorithm
c.	Mutex Locks
d.	All the above

10.	The context-switch time is:
a.	dependent on the underlying hardware support
b.	overhead
c.	shorter in complex OS and PCB
d.	all the above

11.	Which of the following statements is true?
a.	Shared memory is typically faster than message passing.
b.	Message passing is typically faster than shared memory.
c.	Message passing is most useful for exchanging large amounts of data.
d.	Shared

12.	_____ restricts access to a shared variable to only one thread at any given time.
a.	asynchronism
b.	serialization
c.	protection
d.	mutual exclusion

13.	Mutual exclusion can be enforced with a general semaphore whose initial value is:
a.	Greater than 1
b.	Less than 0
c.	Equal 1.
d.	Equal 0

14.	A race condition is when:
a.	several threads try to access the same data concurrently
b.	when several threads try to access and modify the same data concurrently
c.	the outcome of execution does not depend on the order in which instructions are executed
d.	None of the above

15.	_____ occurs when a higher-priority process needs a resource that is currently being accessed by a lower-priority process.
a.	Priority inversion
b.	Deadlock
c.	A race condition
d.	A critical section

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.

11.	12.	13.	14.	15.

16. Circle the right answer

Statement	Answer	
a. A binary semaphore takes on numerical values 0 and 1 only	True	False
b. An atomic operation is one that must be executed to completion without interruption.	True	False
c. While a process is blocked on a semaphore's queue, it is in busy waiting.	True	False
d. User-level threads have no kernel support	True	False
e. `test and set()` instruction requires three operands.	True	False

Question 2. [5 marks]

2-a) [1 mark] Explain the main differences between a short-term and long-term scheduler.

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2-b) [0.5+0.5 mark] Give any TWO reasons for why we need process cooperation.

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2-c) [1 mark] Describe in detail THREE different events that would cause an executing process to stop using CPU and be switched to any other state.

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2-d) [0.5 + 0.5 mark] How many times does each of the programs below print "Hello"?

```
int main (){
  fork( );
  fork( );
  fork( );
  printf("Hello ");
}
```

Ans:

```
int main (){
  fork( );
  printf("Hello ");
  fork( );
  printf("Hello ");
  fork( );
  printf("Hello ");
}
```

Ans:

2-e) [1 mark] Inter-process communication (IPC) can be done either by Shared Memory or Message Passing. What is the main problem with Shared Memory method of IPC?

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Question 3. [5 marks]

3-a) [1 mark] Creating an additional thread is considered to have less cost than creating a new process. Why?

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3-b) [0.5+0.5 mark] Multithreading can be implemented using different techniques: Many-to-One, One-to-One, Many-to-Many.

i) What is the disadvantage of the Many-to-One solution?

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ii) What is the disadvantage of the One-to-One solution?

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3-c) [1 mark] Provide two programming examples in which multithreading provides better performance than a single-threaded solution.

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3-d) [1 mark] The thread cancellation can be performed using one of the two methods: Asynchronous cancellation or Deferred cancellation. Explain the difference between these two methods.

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3-e) [1 mark] What challenges are offered by multicore programming?

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Question 4. [5 marks]

4-a) [1 mark] Briefly describe the characteristics of a complete solution to the critical section problem.

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4-b) [1 mark] Explain how deadlock state occurs between two processes.

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4-c) [0.5 + 0.5 marks] One of the conditions in critical section solutions is that the operation(s) should be executed atomically? What does it mean? What problem occurs if this condition is violated?

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4-d) [1 mark] The critical-section problem could be solved simply in a single-processor by preventing interrupts from occurring while a shared variable was being modified. What problem this technique causes when used in multiprocessor environment?

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4-e) [1 mark] Busy waiting means that a process is waiting for a condition to be satisfied in a tight loop without relinquishing the processor. What problem it causes?

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