KING SAUD UNIVERSITY
COLLEGE OF COMPUTER AND INFORMATION SCIENCES
COMPUTER SCIENCE DEPARTMENT

CSC 227: Operating Systems | **Mid Term 2 Exam** | **Fall 2008/2009**
Date: Jan. 20, 2009 | **Time: 17:00 – 19:00**
Student Name: …… | **ID#: ……** | **Section#: ……**
This examination is close notes and close book.

QUESTION 1 [6 marks]

1. [1 mark] What is a process? What is a thread?

Process: a program in execution.

Thread: a flow of control within a process.

2. [0.5 mark] Give one item of a PCB of a process that is specifically needed by a time-sharing system

Memory management information, CPU scheduling information …

3. [0.5 mark] Mention two other important items in a PCB of a process.

Process id, state, stack, register set …

4. [1 mark] Context switching between kernel threads typically requires saving some items in its TCB. Mention two such items.

Registers and stack.

5. [1 mark] Context switching between processes typically requires saving some items in its PCB. Mention two such items.

Register set, stack, state …

6. [2 marks] Consider two scenarios: a) two user threads are mapped into one kernel thread, and b) each of the two user threads is mapped into a unique kernel thread.
Which achieves better concurrency in execution? Why?

The b) achieves better concurrency since two threads can execute concurrently.
In a), when one thread is blocked or in waiting state, the other thread can not be scheduled to run.

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QUESTION 2 [7 marks]

1. A process can be in one of the following states: ready, running, waiting, and terminated. What event will lead to the following transitions:

- [0.5 mark] Running to ready directly

Interrupt, time-out (end of time slice), arrival of a higher priority process, sleep system call.

- [0.5 mark] Running to waiting directly

Request for I/O, process forks a child, wait for an event, wait system call.

- [0.5 mark] Waiting to ready directly

End of I/O, parent becomes ready after child complete execution.

- [0.5 mark] Waiting to terminated directly

I/O error, parent is exiting, parent kills a child.

2. In general, a process or a thread may contain some or all of the following components: [1] Register values, [2] Heap memory, [3] Global variables, [4] Stack memory, [5] Data segment, [6] TCB, [7] PCB, and [8] Code segment.
Which of these components are shared by the following pairs?

(a) [1 mark] A multi threaded process and one its threads [2], [3], [5], [8]

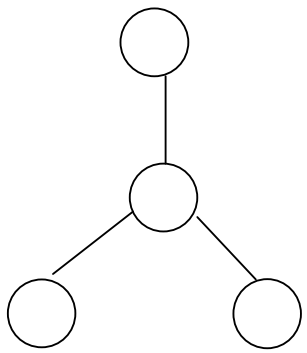
(b) [1 mark] Any two threads in a multithreaded process [2], [3], [5], [8]

(c) [1 mark] Any two child processes of a process [3], [5]

3. [2 marks]

Using fork ( ) system call to create a process, write a pseudo code, to create the process tree in this diagram.

```
int pid = fork ();
if (pid = = 0}
   pid = fork ();
      if (pid > 0)
        fork ( );
```



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QUESTION 3 [7 marks]

1. Five processes, A trough E, arrive at the same time. They have estimated running times of 10, 6, 2, 4, and 8 milliseconds, respectively. Their priorities are 3, 5, 2, 1, and 4, respectively, with 5 being the highest priority. Assume that all processes are completely CPU bound.
   For each of the following scheduling algorithms, draw the Gantt chart and determine the average process turnaround time. Ignore process switching overhead.

1.

(a) 30, 22, 6, 16, 28. avg(turnaround time)= 20.4 milliseconds
(b) 6, 14, 24, 26, 30. avg(turnaround time)= 20 milliseconds
(c) 10, 16, 18, 22, 30. avg(turnaround time)= 19.2 milliseconds
(d) 2, 6, 12, 20, 30. avg(turnaround time)= 14 milliseconds

2. [1 mark] What are the functions of long-term and short-term scheduling?
Job Scheduler – CPU Scheduler.

3. [1 mark] In what way is SJF Optimal?
2. Shortest remaining Time First (Preemptive SJF).

4. [1 mark] Why is it hard to implement SJF as CPU-scheduler?
Prediction of the next CPU burst.