CURTIN UNIVERSITY OF TECHNOLOGY
DEPARTMENT OF COMPUTING

SLIIT

Mid-Semester Test – February 2013

SUBJECT: OPERATING SYSTEMS 200 Index No. 4542

TIME ALLOWED:

Ninety (90) minutes test. The supervisor will indicate when answering may commence.

AIDS ALLOWED:

To be supplied by the Candidate: Nil

To be supplied by the University: Nil

Calculators are NOT allowed.

GENERAL INSTRUCTIONS:

This paper consists of Four (4) questions with a total of 100 marks.

ATTEMPT ALL QUESTIONS

Name: _____

Student No: _____

Tutorial Time/Tutor: _____

QUESTION ONE (total: 26 marks): Operating Systems.

a) **(Total: 4 marks).** Goals of an OS.

(i) **(2 marks).** Describe the main goal of an OS as the resource allocator.

(ii) **(2 marks).** List 4 (four) types of resource that OS allocates to processes.

Answer:

(i)

(ii)

b) **(4 marks).** Describe each of the following terms.

- Multiprogramming system.
- Kernel.

Answer:

- Multiprogramming:

- Kernel:

c) **(Total: 6 marks).** Consider a simple program that reads data from one file and writes the data to another file. Assume the program first asks its user to provide the input file name, and then asks for the output file name, both interactively on the screen.

(i) **(3 marks).** Describe three system calls used when the program is executed. Note: if you provide more than three system calls in your solution, there will be penalty for each incorrect additional answer.

(ii) **(3 marks).** How many system calls can potentially be used when the program completes its execution? Justify your answer.

Answer:

(i)

(ii)

d) **(Total: 6 marks).** Explain why each of the following instructions should be made privileged or not privileged.

- Access I/O devices
- Turn-off interrupts

Answer:

Access I/O devices:

Turn-off interrupts:

e) **(Total: 6 marks).** Microkernel system design.

(i) **(3 marks).** Discuss the historical motivation for introducing the first microkernel designed operating system, Mach.

(ii) **(3 marks).** Explain why microkernel increases system security and reliability.

Answer:

(i)

(ii)

END OF QUESTION ONE

QUESTION TWO (total: 24 marks): Processes and threads

a) **(4 marks).** Describe the differences between a program and its process.

Answer:

b) **(Total: 4 marks).** Assume the following four process states: **ready, waiting, running, terminated**, and a parent process that created a child process using fork() system call.

(i) **(2 marks).** What was the state of the parent process immediately after fork() returns? Why?

(ii) **(2 marks).** Can both processes eventually be in the running state at the same time? Why?

Answer

(i)

(ii)

c) **(5 marks).** Does process cooperation improve computation speedup of a particular task if it runs on a computer system that contains only one CPU? Explain how or why the speedup can be achieved or cannot be achieved.

Answer:

d) **(3 marks).** Which IPC mechanism, shared memory or message passing, is better when processes share only small amount of data. Why?

Answer:

e) **(4 marks).** List four main advantages of using threads as compared to processes.

Answer:

f) **(4 marks).** Suppose you are designing an application that **does not** require I/O operation, and your system supports many-to-one thread model. If you implement the application as a multithreaded program, will your implementation achieve better performance as compared to using a process? Why or why not?

Answer:

END OF QUESTION TWO

QUESTION THREE (total: 27 marks): CPU Scheduling

a) **(Total: 6 marks).**

(i) **(2 marks).** What is an I/O bound process? A CPU bound process?
(ii) **(4 marks).** It is important that a long-term scheduler selects a *good process mix* of I/O bound and CPU bound processes. Explain the reasons.

Answer:

(i)

(ii)

b) **(4 marks).** Why does a time-sharing system often have no long-term scheduler?

Answer:

c) **(4 marks).** Is it possible to design a CPU scheduler that optimizes both the I/O utilization and CPU utilization? Why or why not?

Answer:

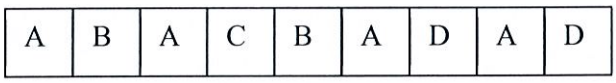
d) **(3 marks).** Could the first-come first-served scheduler result in starvation? Why or why not?

Answer:

e) **(Total: 10 marks).** Consider the following set of processes with their arrival time, priority, and burst time.

Process	Arrival Time	Priority	Burst Time
A	0	3	7
B	1	2	3
C	3	2	2
D	7	1	6

(i) **(6 marks).** What CPU scheduling algorithm, for example FCFS, is used to produce the following Gantt chart from the table? Justify your answer by explaining how the algorithm produces the Gantt chart.



0 2 4 6 8 9 11 13 14 18

(ii) **(4 marks).** Compute the average waiting time from the table and its Gantt chart.

Answer:

(i)

(ii) Waiting time:

END OF QUESTION THREE