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Homework 2

CSC 4103 – Operating Systems

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1) Describe the actions taken by a kernel to context-switch between processes.

- After a clock interrupt, the Operating System saves the PC and user stack pointer and transfers control to the kernel clock interrupt handler.
- The rest of the registers are saved by the clock interrupt handler.
- The Operating System forces the scheduler to determine the next process to execute.
- The registers are then restored and then takes the processor back to the state in which the process was previously interrupted.

2) Which of the following components of program state are shared across threads in a multithread process? Also explain the implications of such state sharing t the efficiency of creating a thread?

- Global Variables
- Heap Memory
- Stack Memory

The threads of multithreaded process share heap memory and global variables.
Each thread has its separate set of register values and a separate stack.

3) Consider the exponential average formula used to predict the length of the next CPU burst. What are the implications of assigning the following values to the parameters used by the algorithm?

a. $\alpha = 0$ and $\tau_0 = 100$ milliseconds

b. $\alpha = 0.99$ and $\tau_0 = 10$ milliseconds

For ‘a’ 100 milliseconds are assumed for the next CPU burst because alpha is 0. For ‘b’ alpha is much higher weight than the past history. The length is predicted because of the scheduling algorithm.

4) What resources are used when a thread is created? How do they differ from those used when a process is created?

Threads use a basic unit of CPU utilization. Resources private to a thread include Thread ID, program counters, register sets, and a stack. Process creation is heavy-weighted while thread creation is light-weighted.

5) A) What is the average turnaround time for the FCFS scheduling algorithm?
B) What is the average turnaround time for the SJF scheduling algorithm?
C) The SJF algorithm is supposed to improve performance, but notice that we chose to run process Pi at time 0 because we did not know that two shorter processes would arrive soon. Compute what the average turnaround time will be if the CPU is left idle for the first 1 unit and then SJF scheduling is used. Remember that processes p1 and P2 are waiting during this idle time, so their waiting time may increase. This algorithm could be known as future-knowledge scheduling.

a. ((0 + 8) + (7.6 + 4) + (11 + 1) / 3 = 10.5333
b. ((0 + 8) + (8.6 + 4) + (7 + 1)) / 3 = 9.5333
c. ((6 + 8) + (1.6 + 4) + (0 + 1)) / 3 = 6.866

6) What is the meaning of the term busy waiting? What other kinds of waiting are there in an operating system? Explain why spinlocks are not appropriate for single-processor systems but are often used in multiprocessor systems.

Busy waiting means waiting for a condition to be met within a tight loop without relinquishing the processor. Relinquishing the processor but setting up a block on a process to be awakened at a later time is another form of waiting. Spinlocks would not work on a single-processor because a process requires an additional process in order to break out of a spinlock. No other processed can be run if a a single processor system is never relinquished.

7) Bankers Algorithm
A) What is the content of the matrix Need?
B) Is the system in a safe state?
C) If a request from process P1 arrives for (0,4,2,0), can the request be granted immediately?

a)

	ABCD
P0	0 0 0 0
P1	0 7 5 0
P2	1 0 0 2
P3	0 0 2 0
P4	0 6 4 2

b) Yes, P0 – P4 satisfy the requirements.
c) Yes, the results of a request from P1 (0, 4, 2, 0) are (1, 1, 0, 0). A possible safe sequence can be P0, P2, P3, P1, and P4.