Operating Systems - Review Questions 1

Deadline: Nov. 13, 2022

1. When a process creates a new process using the `fork()` operation, which of the following states is shared between the parent process and the child process? Stack, Heap, or Shared memory segments?

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2. Explain what the output will be at `LINE A`.

```
int value = 15;
int main() {
  pid t pid;
  pid = fork();

  if (pid == 0) { /* child process */
    value += 10;
    return 0;
  } else if (pid > 0) { /* parent process */
    wait(NULL);
    printf("PARENT: value = %d",value); /* LINE A */
    return 0;
  }
}
```

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3. How many processes are created in the following code?

```
int main() {
  fork();
  fork();
  fork();
}
```

---

4. See Section 4.1 of the "Operating Systems Concepts" book. Does the multithreaded web server described in that section exhibit task or data parallelism?

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5. What are two differences between user-level threads and kernel-level threads? Under what circumstances is one type better than the other?

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6. Describe the actions taken by a kernel to context-switch between kernellevel threads.

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7. Explain the difference between preemptive and nonpreemptive scheduling.

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8. Suppose that the following processes arrive for execution at the times indicated. Each process will run for the amount of time listed. In answering the questions, use nonpreemptive scheduling, and base all

decisions on the information you have at the time the decision must be made.

Process	Arrival Time	Burst Time
P_1	0.0	8
P_2	0.4	4
P_3	1.0	1

a. What is the average turnaround time for these processes with the FCFS scheduling algorithm?

b. What is the average turnaround time for these processes with the SJF scheduling algorithm?

c. The SJF algorithm is supposed to improve performance, but notice that we chose to run process P1 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

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9. Consider the following set of processes, with the length of the CPU burst time given in milliseconds.

Process	Burst Time	Priority
P_1	2	2
P_2	1	1
P_3	8	4
P_4	4	2
P_5	5	3

The processes are assumed to have arrived in the order P1, P2, P3, P4, P5, all at time 0.

a. Draw four Gantt charts that illustrate the execution of these processes using the following scheduling algorithms: FCFS, SJF, nonpreemptive priority (a larger priority number implies a higher priority), and RR (quantum = 2).

b. What is the turnaround time of each process for each of the scheduling algorithms in part a?

c. What is the waiting time of each process for each of these scheduling algorithms?

d. Which of the algorithms results in the minimum average waiting time (over all processes)?