



Tutorial Letter 102/0/2024

Questions for assignment 1

Operating Systems and Architecture

COS3721

Year module

Computer Science Department
School of Computing

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Assignment 1 Questions

Question-1 Coverage : Chapter 1**[10]**

- 1) Identify two advantages and two disadvantages of open-source operating systems. Identify the types of people who would find each aspect to be an advantage or a disadvantage. (4)
- 2) Describe two challenges of designing operating systems for mobile devices compare with designing operating system for traditional PCs. (2)
- 3) Rank the following storage systems from fastest to slowest:
 - a) Hard-disk drives
 - b) Registers
 - c) Optical disk
 - d) Main memory
 - e) Nonvolatile memory
 - f) Magnetic tapes
 - g) Cache(4)

Question 2: Operating-system structures**[08]**

- 1) What are the two models of interprocess communication? (2)
- 2) What are the strengths and weaknesses of the two models of interprocess communication requested in 1) above? (3)
- 3) Explain why Java programs running on Android systems do not use the standard Java API and virtual machine. (3)

Question 3: Processes**[14]**

- 1) Including the initial parent process, how many processes are created by the following program? (4)

```
_____
#include <stdio.h>
#include <unistd.h>

Int main()
{
    int i=0;
    while (i < 5)
        fork();
    return 0;
}
_____
```

- 2) Using the following program, explain what the output will be at lines X and Y. (6)

```

#include <sys/types.h>
#include <stdio.h>
#include <unistd.h>

define SIZE 5

Int unms[SIZE] = {0, 2, 4, 6, 8};

int main ()
{
    int i;
    pid_t pid;
    pid = fork ();
    if (pid == 0) {
        for (i=0; i<SIZE; i++){
            nums[i] *= -1;
            printf("CHILD: %d ", nums[i]); /* LINE X */
        }
    }
    else if (pid > 0 ) {
        wait(NULL);
        for (l = 0; l < SIZE; l++)
            printf ( "PARENT: %d ",nums[l] ); /* LINE Y */
    }
}

```

- 3) Describe the actions taken by a kernel to context-switch between processes. (4)

Question 4: Threads and Concurrency

[24]

- 1) Using Amdahl's law, calculate the speedup gain for the following applications:
- 50 percent parallel with (a) eighteen processing cores and (b) six processing cores (4)
 - 67 percent parallel with (a) seven processing cores and (b) two processing cores (4)
 - 80 percent parallel with (a) four processing cores and (b) eight processing cores (4)

- 2) Consider the following code segment:

```

pid_t pid;
pid = fork ();
if (pid == 0) { /* child process */
    fork();
    thread_create (...);
}
fork ();

```

- How many unique processes are created? (3)
- How many unique threads are created? (3)

- 3) Determine if the following problems exhibit task or data parallelism:.

- a. Using a separate thread to generate a thumbnail for each photo in a collection (2)
- b. Transposing a matrix in parallel (2)
- c. An ETF application that uses different threads to extract data from multiple data sources, transform the extracted data and load the transformed data in the same database (2)

Question 5: CPU Scheduling

[27]

- 1) The following processes are being scheduled using a preemptive, priority-based, round-robin scheduling algorithm:

<u>Process</u>	<u>Priority</u>	<u>Burst</u>	<u>Arrival</u>
P1	3	15	0
P2	8	20	0
P3	5	20	20
P4	5	20	25
P5	4	5	45
P6	4	15	55

Each process is assigned a numerical priority, with a higher number indicating a higher relative priority. The scheduler will execute the highest-priority process. For processes with the same priority, a round-robin scheduler will be used with a time quantum of 10 units. If a process is preempted by a higher-priority process, the preempted process is placed at the end of queue.

- a. Show the scheduling order of the processes using a Gantt chart. (6)
 - b. What is the turnaround time of each process? (4)
 - c. What is the waiting time of each process? (4)
- 2) 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 (5)
 - b. $\alpha = 0.99$ and $\tau_0 = 10$ milliseconds (5)