CSCI 109: Introduction to Computer Science Homework 3

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**Problem 1: Programming**

1. **(a).** 9

**(b).** 30

**(c).** a = logbN

**Problem 2: Programming**

1. **(a).** func(0): 1 times and print out 0

func(1): 2 times and print out 1 and 0

**(b).** The program does not run in polynomial time because it contains a factorial component, which would grow intractably fast.

**Problem 3: Operating Systems**

1. (a). First-come, first served (FCFS) processing:

|  |  |  |  |
| --- | --- | --- | --- |
| Order | Process | Process running time | Total running time |
| 1 | P1 | 26 | 26 |
| 2 | P2 | 3 | 29 |
| 3 | P3 | 12 | 41 |
| 4 | P4 | 6 | 47 |
| 5 | P5 | 18 | 65 |

(b). P1 waits 0 unit of time.

P2 waits 26 units of time.

P3 waits 29 units of time.

P4 waits 41 units of time.

P5 waits 47 units of time.

Average waiting time = (0+26+29+41+47)/5 = 28.6 units of time

(c). P2, P4, P3, P5, P1.

(d). Minimization of FCFS processing:

|  |  |  |  |
| --- | --- | --- | --- |
| Order | Process | Process running time | Total running time |
| 1 | P2 | 3 | 3 |
| 2 | P4 | 6 | 9 |
| 3 | P3 | 12 | 21 |
| 4 | P5 | 18 | 39 |
| 5 | P1 | 26 | 65 |

(e).

P1 waits 0 unit of time.

P2 waits 3 units of time.

P3 waits 9 units of time.

P4 waits 21 units of time.

P5 waits 39 units of time.

Average waiting time = (0+3+9+21+39)/5 = 14.4

(f). round robin scheduling:

|  |  |  |  |
| --- | --- | --- | --- |
| Order | Process | Process running time | Total running time |
| 1 | P1 | 6 | 6 |
| 2 | P2 | 3 | 9 |
| 3 | P3 | 6 | 15 |
| 4 | P4 | 6 | 21 |
| 5 | P5 | 6 | 27 |
| 6 | P1 | 6 | 33 |
| 7 | P3 | 6 | 39 |
| 8 | P5 | 6 | 45 |
| 9 | P1 | 6 | 51 |
| 10 | P5 | 6 | 57 |
| 11 | P1 | 6 | 63 |
| 12 | P1 | 2 | 65 |

P1 waits (65-26) = 39 units of time.

P2 waits (9-3) = 6 units of time

P3 waits (39-12) = 27 units of time

P4 waits (21-6) = 15 units of time

P5 waits (57-18) = 39 units of time

Average waiting time = (39+6+27+15+39)/5= 25.2 units of time

(g). (n-1)\*q

(h). Advantages:

* Short waiting time.
* Fairness is promoted as every process gets equal units of time.

Disadvantages:

* Program has to be frequently interrupted, which lowers the efficiency of CPU.

(i). When a user program needs access to protected resources it makes a system call (e.g., managing files, accessing a printer). Therefore, OS would have very high privilege in running programs so that crash in one program doesn't necessarily crash OS and other programs.