IN1011 Tutorial (practice questions) : Processes and Interrupts

1 Introduction

This tutorial gives you some practice with thinking about processes and the impact of various factors on the execution of a program (e.g. factors such as the number of process states, the number of concurrently running programs, the causes of interrupts, etc.). For revision, please see the prerecorded lecture 1 & 2 videos, as well as the live lecture 1 & 2 sessions on Moodle.

1.1 "Warm up" Questions

For Q1 to Q7 assume: 1) only one user-program is executing; 2) if the program fails, it terminates; 3) the only software interrupts are I/O-related or "traps".

1.1.1

Q1 A user-program eventually successfully terminates from executing on a system. During the program's execution n interrupts occur. What is the:

1. maximum number of interrupts due to requests made by the program?

2. minimum number of interrupts due to requests made by the program?

Q2 A user-program eventually successfully terminates from executing on a system. During the program's execution n interrupts occur. Ignore interrupts for OS operations (e.g. timer interrupts). What is the:

1) maximum number of interrupts due to requests made by the program?

2) minimum number of interrupts due to requests made by the program?

Q3 A user-program eventually successfully terminates from executing on a system. During the program's execution n interrupts occur. Ignore interrupts for OS operations, and assume hardware interrupts occur only in response to the program's requests. What is the:

1) maximum number of interrupts due to requests made by the program?

2) minimum number of interrupts due to requests made by the program?

Q4 A user-program eventually terminates from executing on a system. The program makes no IO requests. During the program's execution n interrupts occur. What is the:

1) maximum number of interrupts due to the program?

2) minimum number of interrupts due to the program?

Q5 A user-program eventually terminates from executing on a system. The program makes one or more I/O requests. During the program's execution n interrupts occur. Ignore interrupts for OS operations, and assume hardware interrupts occur only in successful response to the program's requests. What is the:

1) maximum number of interrupts due to requests made by the program?

2) minimum number of interrupts due to requests made by the program?

Q6 A user-program eventually fails and terminates from executing on a system. During the program's execution n interrupts occur. The program makes no IO requests. Ignore interrupts for OS operations. What is the:

1) maximum number of interrupts due to the program?

2) minimum number of interrupts due to the program?

Q7 A user-program eventually terminates from executing on a system. During the program's execution n interrupts occur. The program makes no IO requests. Ignore interrupts for OS operations. What is the:

1) maximum number of interrupts due to the program?

2) minimum number of interrupts due to the program?

1.2 The Implications of Process States

In the following questions, ignore the time taken by OS instructions to execute. Also, assume no failures or errors occur.

1.2.1

2 user programs, A and B, are required to run on a system with no other user programs. They begin executing at different times and only B makes IO requests. The processes are assigned to the CPU by the OS in the order that they enter into the ready queue[1]. Once assigned to the CPU, a process will execute until it either terminates or makes an IO request (upon which the CPU is reassigned to another process). Each program takes 1sec to execute (ignoring IO times), and each IO request takes 5sec to be serviced.

Q8 Assuming the 2-state process model[2], What is the:

1) maximum time program A could take to execute?

2) minimum time program A could take to execute?

Q9 Assuming the 5-state process model[3], What is the:

1) maximum time program A could take to execute?

2) minimum time program A could take to execute?

Q10 Assuming the 7-state process model[4] and that the programs use a negligible amount of RAM, What is the:

1) maximum time program A could take to execute?

2) minimum time program A could take to execute?

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[1]This is the "not running" queue for the 2-state model.
[2]See prerecorded lecture video 2 (part 2)
[3]See prerecorded lecture video 2 (part 3)
[4]See prerecorded lecture video 2 (part 4)