

COMPSCI 3SH3 Winter, 2021

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**Assignment/Homework 3**, Apr. 6th 2021

Assignment due date: Apr. 18th 23:59:59.

*Note: Please work on this assignment individually. Students copying each other's answer will get a zero and will perform poor on final.*

1. **CPU Scheduling** (4 Marks) Consider a system running ten I/O-bound tasks and one CPU-bound task. Assume that the I/O-bound tasks issue an I/O operation once for every millisecond of CPU computing and that each I/O operation takes 10 milliseconds to complete. Also assume that the context-switching overhead is 0.1millisecond and that all processes are long-running tasks. Describe the CPU utilization for a round-robin scheduler when:
  - The time quantum is 1 millisecond
  - The time quantum is 10 milliseconds
2. **Virtual Memory** (4 Marks) Consider the following page reference string: 1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6. How many page faults would occur for the following replacement algorithms, assuming one, two, three, four, five, six, and seven frames? Remember that all frames are initially empty, so your first unique pages will cost one fault each.
  - LRU replacement
  - FIFO replacement
  - Optimal replacement
3. **Massive Storage** (4 Marks) The reliability of a storage device is typically described in terms of mean time between failures (MTBF).

Although this quantity is called a "time", the MTBF actually is measured in drive-hours per failure.

- a) If a system contains 1,000 disk drives, each of which has a 750,000-hour MTBF, which of the following best describes how often a drive failure will occur in that disk farm: once per thousand years, once per century, once per decade, once per year, once per month, once per week, once per day, once per hour, once per minute, or once per second?
- b) Mortality statistics indicate that, on the average, a U.S. resident has about 1 chance in 1,000 of dying between the ages of 20 and 21. Deduce the MTBF hours for 20-year-olds. Convert this figure from hours to years. What does this MTBF tell you about the expected lifetime of a 20-year-old?

4. **File Management** (4 marks) In a file system, a file header (inode in UNIX term) contains ten pointers (integers) for data sectors. Among the ten pointers, nine are pointers to direct data sectors and one is the pointer to double indirect sectors. Assuming the size of a disk sector is 512 bytes, what is the maximum file size in this system? Note that `sizeof(int)=4`. Show and explain your calculation.