Score:_____    Name:_____

## ECE 3055 Quiz -  November 5, 2003

**1-3**. Determine the number of page faults that will occur in the following page reference string assuming 4 page frames are available. All frames are initially empty.

1,   2,   4,   3,   1,   2,   6,   5,   2,   1,   2,   3,   7,   5,   8,   2,   1,   2,   3,   6

**3 pts.**

**Page Frames**

| 1 | 1 | | 1 | 1 | 1 | 6 | 6 | 6 | 6 | 6 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 |
| | 2 | 2 | 2 | 2 | 2 | 2 | 5 | 5 | 5 | 5 | 5 | 7 | 7 | 7 | 7 | 1 | 1 | 1 | 1 |
| | | | 4 | 4 | 4 | 4 | 4 | 2 | 2 | 2 | 2 | 2 | 5 | 5 | 5 | 5 | 5 | 3 | 3 |
| | | | | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 8 | 8 | 8 | 8 | 6 |

**Page Fault Y/N**

| Y | Y | Y | Y | Y | N | N | Y | Y | Y | Y | N | Y | Y | Y | Y | Y | Y | N | Y | Y |

**1. With the FIFO algorithm, __16__ page faults will occur.**

**3 pts.**

**Page Frames**

| 1 | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 5 | 5 | 5 | 5 | 5 | 3 | 3 |
| | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 8 | 8 | 8 | 8 | 8 | 8 | 6 |
| | | 4 | 4 | 4 | 4 | 6 | 6 | 6 | 6 | 6 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 |
| | | | 3 | 3 | 3 | 3 | 5 | 5 | 5 | 5 | 5 | 7 | 7 | 7 | 7 | | | | |

**Page Fault Y/N**

| Y | Y | Y | Y | N | N | Y | Y | N | N | N | Y | Y | Y | Y | Y | Y | N | Y | Y |

**2. With the LRU algorithm, __14__ page faults will occur.**

**3 pts.**

**Page Frames**

| 1 | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | | 4 | 4 | 4 | 6 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 8 | 8 | 8 | 8 | 8 | 6 | |
| | | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 7 | 7 | 7 | 7 | 7 | 7 | 3 | 3 | |

**Page Fault Y/N**

| Y | Y | Y | Y | N | N | Y | Y | N | N | N | N | Y | N | Y | N | N | N | Y | Y |

**3. With the best possible algorithm, a minimum of __10__ page faults will occur.**

**4.** Other than having an automatic system to swap data to/from the disk and the ability to run program(s) larger than physical memory, what is the other main advantage gained for a secure multiprocessing OS by having a virtual memory system?

**1 pts**

more security with hardware memory protection
higher cpu utilization with increased
degree of multiprogramming