Name:

Read Ch 7, 8, 9.

Due Thursday November 6.

Type, please. 10-11 point times (serif) roman (not italic, no bold) or similar, single or 1.5 spaced, 1 inch margins. (I don’t mean to define a specific style; missing one or two of these is fine, I won’t grade it down.)

As always, if you use sources on-line (e.g., wikipedia, pages found by google, man pages), please cite. This assignment is meant to be done individually.

Point totals are approximate, subject to change.

1. (2 points) Contrast internal and external fragmentation.

2. Consider a system with a 32-bit logical address and 4-KB pages. The system supports up to 512 MB physical memory. How many entries are there in:
   i. (1 point) a conventional single-level page table
   ii. (1 point) an inverted page table

3. (2 points) What is the purpose of paging the page tables?

4. (2 points) How large is the page table of a process that can address 2 GB in 4 KB pages. (32 bit addresses; assume only 8 bits are needed for flags.) (This is an ordinary page table, not hierarchical, not inverted, not hash based.)

5. (6 points) (9.8) 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 faults would occur for the following three replacement algorithms assuming one, two, three, four, five, six, seven frames.

<table>
<thead>
<tr>
<th>scheme</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>LRU</td>
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<td>OPT</td>
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</tr>
</tbody>
</table>

6. A simplified view of thread states includes only Ready, Running, and Blocked.
   i. (1 point) Will a thread change state if it incurs a page fault? If so, to what state?
   ii. (1 point) Will a thread change state if it incurs a TLB miss that is resolved in the page table? If so, to what state?

7. (2 points) What hardware support is required to implement copy-on-write?

8. If you’re monitoring the rate at which the pointer in the clock algorithm advances, what can you say about the system if
   i. (1 point) The pointer is moving fast.
   ii. (1 point) The pointer is moving slow or is still.