**CS149**

**HW5**

**Jooyul Yoon**

**014597154**

Q1.

1. Coffman’s condition
   * Mutual exclusion
     + Satisfied. Only one thread between thread 0 and thread 2 can use the resource Y.
   * Hold and wait
     + Satisfied. No thread owns both resource X and Y.
   * No preemption
     + Not satisfied. Resource X can be released by thread 1 after it complete its execution.
   * Circular wait
     + Satisfied. Thread 0, Resource X, Thread 2, and Resource Y forms circular wait.
2. Deadlock will not occur. Thread 1 doesn’t need to wait, so it can complete its execution. After that, one instance is left in the resource X, so thread 0 can own X, then thread 0 will also complete its execution. Then, thread 2 will not wait for resource Y and thread 2 will also complete its execution.

Q2.

* 1. Why the differences?
     + A page is always of sixed block size whereas, a segment is a variable size.
     + Block size in paging is specified by the hardware while variable size of segmentation is specified by the user.
     + Paging can lead to internal fragmentation because the page is of fixed block size. The segmentation can lead to external fragmentation as the memory is filled with the variable sized blocks.
  2. Can we record base in a page table?
     + Address bits in page table are called frames and it only recognizes as frames, therefore, the base in page table cannot be recorded.
  3. Why there is no limit or length in a page table?
     + All pages are the same size; thus, the limit is obvious.

Q3.

1. Make a list of all logical address ranges (in decimals, byte-level) that would cause page faults.

Logical address ranges that result in page fault are for page 2, 4, 5, 7

* + page #2: 010 0000 to 010 1111
    - 32 ~ 47
  + page #4: 100 0000 to 100 1111
    - 64 ~ 79
  + page #5: 101 0000 to 101 1111
    - 80 ~ 95
  + page #7: 111 0000 to 111 1111
    - 112 ~ 127

01

1. What are the corresponding physical addresses (in decimals, byte-level) of the following logical addresses (in decimals, byte-level)? If any address conversion is not possible, explain its reason.
   * 1 => 33
   * 50 => 18
   * 95 => N/A, frame not in memory
   * 96 => 48
   * 120 => N/A, frame not in memory

95, 120 is not possible because the corresponding physical frame

Q4.

1. FIFO

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Reference** | **7** | **2** | **3** | **1** | **2** | **5** | **3** | **4** | **6** | **7** | **7** | **1** | **0** | **5** |
| **Frame 0** | 7 | 7 | 7 | 1 | 1 | 1 | 1 | 1 | 6 | 6 | 6 | 6 | 0 | 0 |
| **Frame 1** | X | 2 | 2 | 2 | 2 | 5 | 5 | 5 | 5 | 7 | 7 | 7 | 7 | 5 |
| **Frame 2** | X | X | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 1 | 1 | 1 |
| **Page fault** | Y | Y | Y | Y | N | Y | N | Y | Y | Y | N | Y | Y | Y |

Total page fault: 11

1. LRU

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Reference** | **7** | **2** | **3** | **1** | **2** | **5** | **3** | **4** | **6** | **7** | **7** | **1** | **0** | **5** |
| **Frame 0** | 7 | 7 | 7 | 1 | 1 | 1 | 1 | 1 | 1 | 7 | 7 | 7 | 7 | 5 |
| **Frame 1** | X | 2 | 2 | 2 | 2 | 5 | 5 | 5 | 5 | 4 | 4 | 1 | 1 | 1 |
| **Frame 2** | X | X | 3 | 3 | 3 | 3 | 3 | 4 | 6 | 6 | 6 | 6 | 0 | 0 |
| **Page fault** | Y | Y | Y | Y | N | Y | N | Y | Y | Y | N | Y | Y | Y |

Total page fault: 12

1. OPT

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Reference** | **7** | **2** | **3** | **1** | **2** | **5** | **3** | **4** | **6** | **7** | **7** | **1** | **0** | **5** |
| **Frame 0** | 7 | 7 | 7 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **Frame 1** | X | 2 | 2 | 2 | 2 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| **Frame 2** | X | X | 3 | 3 | 3 | 3 | 3 | 4 | 6 | 7 | 7 | 7 | 0 | 0 |
| **Page fault** | Y | Y | Y | Y | N | Y | N | Y | Y | Y | N | N | Y | N |

Total page fault: 9

Extra Credit

Text, chat or text message

Description automatically generated