**Demand paging problems (page replacement algorithms):**

1. For the following reference string apply the FIFO page replacement algorithm.

* Option 1 – according to Week 6 – Textbook Readings:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Reference string | **2** | **4** | **5** | **6** | **1** | **5** | **3** | **4** | **5** | **2** | **3** | **6** | **5** | **3** | **4** | **7** | **3** | **5** | **6** |
| Physical frame 0 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 7 | 7 | 7 | 7 |
| Physical frame 1 |  | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 3 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 5 | 5 |
| Physical frame 2 |  |  | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 3 | 3 | 6 |
| Physical frame 3 |  |  |  | 6 | 6 | 6 | 6 | 6 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 4 |
| Page faults | F | F | F | F | F | - | F | F | F | F | - | F | - | F | F | F | - | F | F |
| Victim frames |  |  |  |  | 0 |  | 1 | 2 | 3 | 0 |  | 1 |  | 2 | 3 | 0 |  | 1 | 2 |

OR

* Option 2 – according to Week 6 - Module Readings

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Reference string | **2** | **4** | **5** | **6** | **1** | **5** | **3** | **4** | **5** | **2** | **3** | **6** | **5** | **3** | **4** | **7** | **3** | **5** | **6** |
| Physical frame 0 | 2 | 4 | 5 | 6 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Physical frame 1 |  | 2 | 4 | 5 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Physical frame 2 |  |  | 2 | 4 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Physical frame 3 |  |  |  | 2 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Page faults | F | F | F | F |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Victim frames |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

1. For the following reference string apply the OPT page replacement algorithm.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Reference string | **2** | **4** | **5** | **6** | **1** | **5** | **3** | **4** | **5** | **2** | **3** | **6** | **5** | **3** | **4** | **7** | **3** | **5** | **6** |
| Physical frame 0 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| Physical frame 1 |  | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 7 | 7 | 7 | 7 |
| Physical frame 2 |  |  | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Physical frame 3 |  |  |  | 6 | 1 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Page faults | F | F | F | F | F | - | F | - | - | - | - | F | - | - | - | F | - | - | - |
| Victim frames |  |  |  |  | 3 |  | 3 |  |  |  |  | 0 |  |  |  | 1 |  |  |  |

1. For the following reference string apply the LRU page replacement algorithm.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Reference string | **2** | **4** | **5** | **6** | **1** | **5** | **3** | **4** | **5** | **2** | **3** | **6** | **5** | **3** | **4** | **7** | **3** | **5** | **6** |
| Physical frame 0 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 4 | 4 | 4 | 4 | 6 |
| Physical frame 1 |  | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Physical frame 2 |  |  | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Physical frame 3 |  |  |  | 6 | 6 | 6 | 6 | 4 | 4 | 4 | 4 | 6 | 6 | 6 | 6 | 7 | 7 | 7 | 7 |
| Page faults | F | F | F | F | F | - | F | F | - | F | - | F | - | - | F | F | - | - | F |
| Victim frames |  |  |  |  | 0 |  | 1 | 3 |  | 0 |  | 3 |  |  | 0 | 3 |  |  | 0 |

1. For the following reference string apply the LFU page replacement algorithm.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Reference string | **2** | **4** | **5** | **6** | **1** | **5** | **3** | **4** | **5** | **2** | **3** | **6** | **5** | **3** | **4** | **7** | **3** | **5** | **6** |
| Physical frame 0 | 2 | 2 | 2 | 2 | 1 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 7 | 3 | 3 | 3 |
| Physical frame 1 |  | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| Physical frame 2 |  |  | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Physical frame 3 |  |  |  | 6 | 6 | 6 | 6 | 6 | 6 | 2 | 2 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| Page faults | F | F | F | F | F | - | F | - | - | F | - | F | - | - | - | F | F | - | - |
| Victim frames |  |  |  |  | 0 |  | 0 |  |  | 3 |  | 3 |  |  |  | 0 | 0 |  |  |