**Operating Systems Assignment #7**

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Problem 7.1:

**Free Blocks:**

17 KiB, 8 KiB, 10 KiB, 21 KiB, 12 KiB, 13 KiB

1. **11KiB:** 17 KiB, 8 KiB, 10 KiB, 21 KiB, 1 KiB, 13 KiB

**9 KiB:** 17 KiB, 8 KiB, 1 KiB, 21 KiB, 1 KiB, 13 KiB

**7 KiB:** 17 KiB, 1 KiB, 1 KiB, 21 KiB, 1 KiB, 13 KiB

**16 KiB:** 1 KiB, 1 KiB, 1 KiB, 21 KiB, 1 KiB, 13 KiB

1. 17 KiB, 8 KiB, 10 KiB, 21 KiB, 12 KiB, 13 KiB

**11 KiB:** 17 KiB, 8 KiB, 10 KiB, 10 KiB, 12 KiB, 13 KiB

**9 KiB:** 8 KiB, 8 KiB,10 KiB, 10 KiB, 12 KiB, 13 KiB

**7 KiB:** 8 KiB, 8 KiB,10 KiB, 10 KiB, 12 KiB, 6 KiB

**16 KiB:** Cannot Allocate – Memory Allocation Failure

1. 17 KiB, 8 KiB, 10 KiB, 21 KiB, 12 KiB, 13 KiB

**11 KiB:** 6 KiB, 8 KiB, 10 KiB, 21 KiB, 12 KiB, 13 KiB

**9 KiB:** 6 KiB, 8 KiB, 1 KiB, 21 KiB, 12 KiB, 13 KiB

**7 KiB:** 6 KiB, 1 KiB, 1 KiB, 21 KiB, 12 KiB, 13 KiB

**16 KiB:** 6 KiB, 1 KiB, 1 KiB, 5 KiB, 12 KiB, 13 KiB

1. 17 KiB, 8 KiB, 10 KiB, 21 KiB, 12 KiB, 13 KiB

**11 KiB:** 6 KiB, 8 KiB, 10 KiB, 21 KiB, 12 KiB, 13 KiB

**9 KiB:** 6 KiB, 8 KiB, 1 KiB, 21 KiB, 12 KiB, 13 KiB

**7 KiB:** 6 KiB, 8 KiB, 1 KiB, 14 KiB, 12 KiB, 13 KiB

**16 KiB:** Cannot Allocate – Memory Allocation Failure

Problem 7.2:

A paper with writing on it

Description automatically generated

A: 128 KiB - 113 KiB = 15 KiB

B: 64 KiB - 56 KiB = 8 KiB

C: 128 KiB - 82 KiB = 46 KiB

D: 32 KiB - 30 KiB = 2 KiB

E: 64 KiB - 42 KiB = 22 KiB

F: 64 KiB - 48 KiB = 16 KiB

15+8+46+2+22+16 = 109 KiB

The largest chunk of memory is 32KiB that can be allocated.

1. If process C returns, 128 KiB is freed. We now have 128 KiB and 32 KiB free, but 132 KiB cannot be allocated since they aren't contiguous. Hence, allocation of 132 KiB is not possible.

Problem 7.3: ­

1. First-In-First-Out (FIFO) page replacement algorithm:

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Reference string | 1 | 4 | 2 | 3 | 4 | 4 | 1 | 3 | 2 | 1 |
| Frame 0 | 1 | 1 | 2 | 2 | 4 | 4 | 4 | 3 | 3 | 1 |
| Frame 1 |  | 4 | 4 | 3 | 3 | 3 | 1 | 1 | 2 | 2 |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Reference string | 1 | 4 | 2 | 3 | 4 | 4 | 1 | 3 | 2 | 1 |
| Frame 0 | 1 | 1 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Frame 1 |  | 4 | 4 | 4 | 4 | 4 | 1 | 1 | 1 | 1 |
| Frame 2 |  |  | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |

1. Belady’s Optimal (BO) page replacement algorithm:

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Reference string | 1 | 4 | 2 | 3 | 4 | 4 | 1 | 3 | 2 | 1 |
| Frame 0 | 1 | 1 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 2 |
| Frame 1 |  | 4 | 4 | 4 | 4 | 4 | 1 | 1 | 1 | 1 |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Reference string | 1 | 4 | 2 | 3 | 4 | 4 | 1 | 3 | 2 | 1 |
| Frame 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Frame 1 |  | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| Frame 2 |  |  | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 2 |

1. Lease Recently Used Algorithm:

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Reference string | 1 | 4 | 2 | 3 | 4 | 4 | 1 | 3 | 2 | 1 |
| Frame 0 | 1 | 1 | 2 | 2 | 4 | 4 | 4 | 3 | 3 | 1 |
| Frame 1 |  | 4 | 4 | 3 | 3 | 3 | 1 | 1 | 2 | 2 |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Reference string | 1 | 4 | 2 | 3 | 4 | 4 | 1 | 3 | 2 | 1 |
| Frame 0 | 1 | 1 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Frame 1 |  | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 2 |
| Frame 2 |  |  | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |