# OS Problem Sheet #7

Joshua Law

## Problem 7.1: *positioning algorithms*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Best-fit Algorithm | | | | | | | |
|  | 12KiB | 5KiB | 19KiB | 13KiB | 7KiB | 8KiB | 16KiB |
| 14KiB: |  |  |  |  |  |  | 14KiB |
| 9KiB: | 9KiB |  |  |  |  |  |  |
| 7KiB: |  |  |  |  | 7KiB |  |  |
| 10KiB: |  |  |  | 10KiB |  |  |  |
| Result | 3KiB | 5KiB | 19KiB | 3KiB | 0KiB | 8KiB | 2KiB |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Worst-fit Algorithm | | | | | | | |
|  | 12KiB | 5KiB | 19KiB | 13KiB | 7KiB | 8KiB | 16KiB |
| 14KiB: |  |  | 14KiB |  |  |  |  |
| 9KiB: |  |  |  |  |  |  | 9KiB |
| 7KiB: |  |  |  | 7KiB |  |  |  |
| 10KiB: | 10KiB |  |  |  |  |  |  |
| Result | 2KiB | 5KiB | 5KiB | 4KiB | 7KiB | 8KiB | 7KiB |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| First-fit Algorithm | | | | | | | |
|  | 12KiB | 5KiB | 19KiB | 13KiB | 7KiB | 8KiB | 16KiB |
| 14KiB: |  |  | 14KiB |  |  |  |  |
| 9KiB: | 9KiB |  |  |  |  |  |  |
| 7KiB: |  |  |  | 7KiB |  |  |  |
| 10KiB: |  |  |  |  |  |  | 10KiB |
| Result | 3KiB | 5KiB | 5KiB | 4KiB | 7KiB | 8KiB | 6KiB |

1. D

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Next-fit Algorithm | | | | | | | |
|  | 12KiB | 5KiB | 19KiB | 13KiB | 7KiB | 8KiB | 16KiB |
| 14KiB: |  |  | 14KiB |  |  |  |  |
| 9KiB: |  |  |  | 9KiB |  |  |  |
| 7KiB: |  |  |  |  | 7KiB |  |  |
| 10KiB: |  |  |  |  |  |  | 10KiB |
| Result | 12KiB | 5KiB | 5KiB | 4KiB | 0KiB | 8KiB | 6KiB |

## Problem 7.2: *buddy system*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 512KiB | | | | | | |
| A:59+5 | B:27+5 | C:44+20 | D:115+13 | E:28+4 | F:98+30 | 32+32 |
| 64KiB | 32KiB | 64KiB | 128KiB | 32KiB | 128KiB | 64KiB |

Chart, diagram, box and whisker chart

Description automatically generated

1. Overall Internal Fragmentation = 5 + 5 + 20 + 13 + 4 + 30 = 77KiB
2. A subsequent allocation G with 132KiB would require 256KiB(28) to be allocated, but the remaining segments are 128KiB and two 32KiB, hence allocation G would not be able to be accommodated.

## Problem 7.3: *page replacement algorithms*

1. First In First Out (FIFO)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| reference string | 1 | 2 | 3 | 4 | 1 | 1 | 4 | 2 | 1 | 2 |
| frame 0 | 1 | 1 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 |
| frame 1 |  | 2 | 2 | 4 | 4 | 4 | 4 | 2 | 2 | 2 |
| faults | X | X | X | X | X | ✓ | ✓ | X | ✓ | ✓ |

Page Faults = 6

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| reference string | 1 | 2 | 3 | 4 | 1 | 1 | 4 | 2 | 1 | 2 |
| frame 0 | 1 | 1 | 1 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| frame 1 |  | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 |
| frame 2 |  |  | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| faults | X | X | X | X | X |  |  | X |  |  |

Page Faults = 6

1. Belady’s Optimal (BO)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| reference string | 1 | 2 | 3 | 4 | 1 | 1 | 4 | 2 | 1 | 2 |
| frame 0 | 1 | 1 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 |
| frame 1 |  | 2 | 2 | 4 | 4 | 4 | 4 | 2 | 2 | 2 |
| faults | X | X | X | X | X |  |  | X |  |  |

Page Faults = 6

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| reference string | 1 | 2 | 3 | 4 | 1 | 1 | 4 | 2 | 1 | 2 |
| frame 0 | 1 | 1 | 1 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| frame 1 |  | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 |
| frame 2 |  |  | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| faults | X | X | X | X | X |  |  | X |  |  |

Page Faults = 6

1. Least Recently Used (LRU)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| reference string | 1 | 2 | 3 | 4 | 1 | 1 | 4 | 2 | 1 | 2 |
| frame 0 | 1 | 1 | 3 | 3 | 1 | 1 | 1 | 2 | 2 | 2 |
| frame 1 |  | 2 | 2 | 4 | 4 | 4 | 4 | 4 | 1 | 1 |
| faults | X | X | X | X | X |  |  | X | X |  |

Page Faults = 7

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| reference string | 1 | 2 | 3 | 4 | 1 | 1 | 4 | 2 | 1 | 2 |
| frame 0 | 1 | 1 | 1 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| frame 1 |  | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 |
| frame 2 |  |  | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| faults | X | X | X | X | X |  |  | X |  |  |

Page Faults = 6