

# Assignment 5

## 1. first-fit

|      |     |     |     |      |     |      |     |      |     |     |      |
|------|-----|-----|-----|------|-----|------|-----|------|-----|-----|------|
| free | P10 | P1  | P3  | free | P11 | free | P12 | free | P13 | P2  | free |
| 100  | 10  | 212 | 112 | 176  | 20  | 200  | 30  | 300  | 40  | 417 | 183  |

P4 cannot be placed.

## best-fit

|      |     |     |      |     |     |      |     |     |      |     |     |      |
|------|-----|-----|------|-----|-----|------|-----|-----|------|-----|-----|------|
| free | P10 | P2  | free | P11 | P3  | free | P12 | P1  | free | P13 | P4  | free |
| 100  | 10  | 417 | 83   | 20  | 112 | 88   | 30  | 210 | 88   | 40  | 426 | 174  |

## worst-fit

|      |     |     |      |     |      |     |      |     |     |     |      |
|------|-----|-----|------|-----|------|-----|------|-----|-----|-----|------|
| free | P10 | P2  | free | P11 | free | P12 | free | P13 | P1  | P3  | free |
| 100  | 10  | 417 | 83   | 20  | 200  | 30  | 300  | 40  | 212 | 112 | 276  |

P4 cannot be placed.

## next-fit

|      |     |     |      |     |      |     |      |     |     |     |      |
|------|-----|-----|------|-----|------|-----|------|-----|-----|-----|------|
| free | P10 | P1  | free | P11 | free | P12 | free | P13 | P2  | P3  | free |
| 100  | 10  | 212 | 288  | 20  | 200  | 30  | 300  | 40  | 417 | 112 | 71   |

P4 cannot be placed.

2.

| Logical address | Page Number | Page Offset | Physical address |
|-----------------|-------------|-------------|------------------|
| 1027            | 2           | 3           | 3                |
| 2058            | 4           | 10          | 522              |
| 522             | 1           | 10          | 522              |
| 5               | 0           | 5           | 1541             |
| 2047            | 3           | 511         | 2554             |

$$1027 = 2 \times 512 + 3$$

$$0 \times 512 + 3 = 3$$

$$2058 = 4 \times 512 + 10$$

$$1 \times 512 + 10 = 522$$

$$522 = 1 \times 512 + 10$$

$$1 \times 512 + 10 = 522$$

$$5 = 0 \times 512 + 5$$

$$3 \times 512 + 5 = 1541$$

$$2047 = 3 \times 512 + 511$$

$$4 \times 512 + 511 = 2554$$



3. a)  $2\text{KiB} = 2048 = 2^{11}$   
 $2^{32} / 2^{11} = 2^{21}$  entries

b)  $128\text{MiB} = 2^{27}$   
 $2\text{KiB} = 2^{11}$   
 $2^{27} / 2^{11} = 2^{16}$  entries

4. a) time = look up table time + reference page time  
 $= 150\text{ns} + 150\text{ns}$   
 $= 300\text{ns}$

b) time =  $(1 - 0.8) \times (20\text{ns} + 2 \times 150) + 0.8 \times (20\text{ns} + 150\text{ns})$   
 $= 0.2 \times 320\text{ns} + 0.8 \times 170\text{ns}$   
 $= 64\text{ns} + 136\text{ns}$   
 $= 200\text{ns}$

5. LRU

|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |   |    |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|---|----|
| 1 | 2 | 1 | 4 | 2 | 1 | 5 | 2 | 4 | 7 | 5 | 4 | 1 | 4 | 7 | 1 | 4 | 2  | 1 | 7  |
| 1 | 1 |   | 1 |   |   | 1 |   | 4 | 4 | 4 |   | 4 |   | 4 |   |   | 4  |   | 7  |
|   | 2 |   | 2 |   |   | 2 |   | 2 | 2 | 5 |   | 5 |   | 7 |   |   | 2  |   | 2  |
|   |   |   | 4 |   |   | 5 |   | 5 | 7 | 7 |   | 1 |   | 1 |   |   | 1  |   | 1  |
| 1 | 2 | 3 |   |   |   | 4 |   | 5 | 6 | 7 |   | 8 | 9 |   |   |   | 10 |   | 11 |

11 page faults

Optimal

|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 1 | 4 | 2 | 1 | 5 | 2 | 4 | 7 | 5 | 4 | 1 | 4 | 7 | 1 | 4 | 2 | 1 | 7 |
| 1 | 1 |   | 1 |   |   | 5 |   |   | 5 |   |   | 1 |   |   |   |   | 1 |   |   |
|   | 2 |   | 2 |   |   | 2 |   |   | 7 |   |   | 7 |   |   |   |   | 7 |   |   |
|   |   |   | 4 |   |   | 4 |   |   | 4 |   |   | 4 |   |   |   |   | 2 |   |   |
| 1 | 2 | 3 |   |   |   | 4 |   |   | 5 |   |   | 6 |   |   |   |   | 7 |   |   |

7 page faults