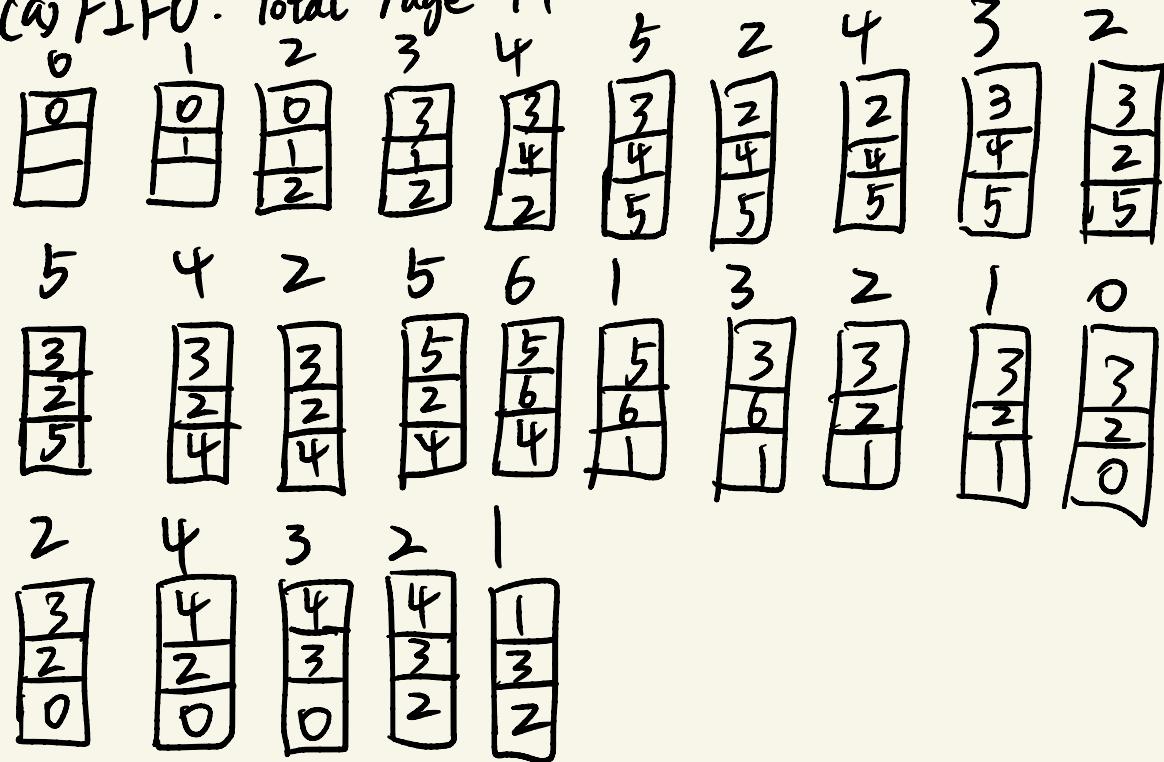


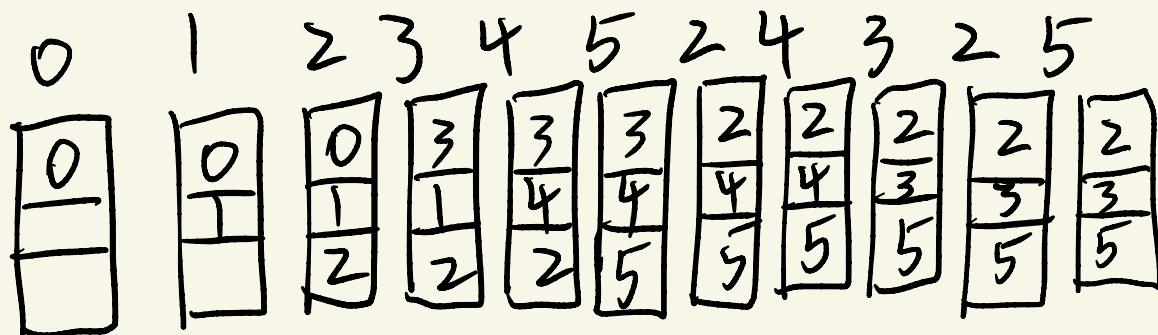
COMP2432 A2
JIANG Guanlin
21093962D

1. Page Replacement

(a) FIFO: Total Page = 19.



(b) Optimal: total Page = 14



4	2	5	6	1	3	2	1	0	2	4	3
2 4 5	2 4 5	2 4 5	2 4 6	2 4 1	2 3 1	2 3 1	2 3 1	2 3 0	2 3 0	2 3 4	2 3 4

2 1

2 3 4	2 3 1
-------------	-------------

(C) LRU: total page: 18

0	1	2	3	4	5	2	4	3	2	5	4
0 1 2	0 1 2	0 1 2	3 1 2	3 4 2	3 4 5	2 4 5	2 4 5	2 4 3	2 4 3	2 5 3	2 5 4

2	5	6	1	3	2	1	0	2	4	3	2
2 5 4	2 5 4	2 5 6	1 5 6	1 3 6	1 3 2	1 3 2	1 0 2	1 0 2	4 0 2	4 3 2	4 3 2

Stack in (c)

$$\begin{array}{r}
 \text{Stack m (c)} \\
 \begin{array}{ccccccccc}
 x & x & 2 & 3 & 4 & 5 & 2 & 4 & 3 \\
 x & 1 & 1 & 2 & 3 & 4 & 5 & 5 & 4 \\
 0 & 0 & 0 & 1 & 2 & 3 & 4 & 2 & 2 \\
 \hline
 0 & 2 & 4 & 3 & 2 & 1 \\
 2 & 0 & 2 & 4 & 3 & 2 \\
 1 & 1 & 0 & 4 & 4 & 3
 \end{array}
 \end{array}$$

4 Frames :

(as FIFO(4)): Total Page: 13

0 0 0 0 4 4 4 4 4 4 4 4 4 4 4 4 4 3
1 1 1 1 5 5 5 5 5 5 5 5 5 5 5 5 5 5
2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 6
3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 1

3	3	3	3	3	3	3	1
2	2	2	2	2	2	2	2
6	6	0	0	0	0	0	0
1	1	1	1	4	4	4	4

(b) Optimal (4): Total Page: 10

4023 4023

(c) LRU (4): Total Page: 14

0	0	0	0	4	4	4	4	4	4	4	4	4	4	1	1	1	1	1	3	3	3
1	1	1	1	5	5	5	5	5	5	5	5	5	5	5	5	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	4	
3	3	3	3	3	3	3	3	3	3	3	3	3	3	6	6	6	6	0	0	0	

stack:

x	x	x	3	4	5	2	4	3	2	5	4	2	5	6	1	3	2	1	0	2	4	3	2	1
x	x	2	2	3	3	3	3	2	3	3	3	3	2	6	6	6	6	3	0	0	0	0	4	2
x	1	1	1	2	2	5	2	5	5	2	2	5	2	5	2	5	3	3	2	3	2	4	4	2
0	0	0	0	1	4	4	5	4	4	4	5	4	4	4	5	1	1	2	1	1	1	2	3	3

(d) FIFO:

0 1 3 2 3 4 5 2 4 3 2 5 4 2 5 6 1 3 2 1 0 2 4 3 2 |

LRU:

0 1 2 3 2 4 5 2 4 3 2 5 4 2 5 6 1 3 2 1 0 2 4 3 2 |

(e)

FIFO:

0 1 2 3 4 5 2 4 3 2 5 4 2 5 6 1 3 2 0 4 3 2 |

LRU:

0 1 2 3 4 5 2 4 3 2 5 4 2 1 5 6 3 2 0 4 3 2 |

2. KBS(3):

$$P=10$$

$P=10$	0	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
-1	1	1	4	4	5	4	5	5	5	3	3	4	4	4	4	5	5	5	5	5
1	2	2	2	5	5	5	5	5	5	4	4	4	4	4	4	6	5	5	5	5
2	2	2	2	5	5	5	5	5	5	4	4	4	4	4	4	1	0	0	4	3

Page = 18

$$P=5:$$

Page = 16

KB5(4):

$$P=10^{-5}$$

Page = 13

P=5:

D O 5 5 5 5 5 5 0 0
- 1 2 1 2 3 6 1 2 2 2 2 4 1 2 3

Page: 13

KBS better than LRU. Some special case will be better, but KBS and LRU don't have that much difference.

3. Q3 Need

P ₀	1	2	1	0
P ₁	1	0	1	0
P ₂	1	2	3	1
P ₃	1	1	0	2
P ₄	1	2	1	1
P ₅	1	1	0	0

(a)

$$1110 \xrightarrow[2101]{P_1} 3211 \xrightarrow[2022]{P_5} 5233 \xrightarrow[1012]{P_0} 6245 \xrightarrow[2101]{P_2} 8346 \xrightarrow[2110]{P_3}$$
$$10456 \xrightarrow[1112]{P_4} 11568$$

① P₁ → P₅ → P₀ → P₂ → P₃ → P₄

② P₁ → P₅ → P₃ → P₄ → P₀ → P₂

③ P₅ → - - - - -

$$3A3 \times 1C_2 = 12$$

∴ The number of sequence is 12.

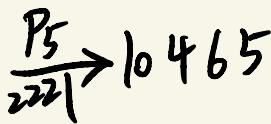
(b)

There have P_x is under reporting but also in safe, so which no effect. P_x will not be P₁, so must be P₅, when change A, still will be safe.

(C) Y_1 will be affect the safe if not consider Y_2 , P_5 is safe
for the 0's in (b), if B is changed, the safe state will be
shift, $\begin{cases} P_3 \Rightarrow P_5 \\ Y_1 \Rightarrow B \end{cases}$

4.

(a)



- ① $P_2 \rightarrow P_4 \rightarrow P_1 \rightarrow P_0 \rightarrow P_3 \rightarrow P_5$
- ② $P_2 \rightarrow P_4 \rightarrow P_1 \rightarrow P_3 \rightarrow P_0 \rightarrow P_5$
- ③ $P_2 \rightarrow P_4 \rightarrow P_1 \rightarrow P_5 \rightarrow P_0 \rightarrow P_3$
- ④ $P_2 \rightarrow P_4 \rightarrow P_1 \rightarrow P_0 \rightarrow P_5 \rightarrow P_3$
- ⑤ $P_2 \rightarrow P_4 \rightarrow P_1 \rightarrow P_3 \rightarrow P_5 \rightarrow P_0$
- ⑥ $P_2 \rightarrow P_4 \rightarrow P_1 \rightarrow P_5 \rightarrow P_3 \rightarrow P_0$

∴ Have 6 number of sequences

(b)

$$P_x \Rightarrow P_2$$

if increase P_2 by 2, the P_2 will be unsafe.

(c) $P_2 \Rightarrow D$, so Will be deadlock, and the error will be cause the result not sure.

For P_2, P_4, P_1 , if increase of D , first three can be change, and result will be unsafe. so $P_4 \Rightarrow P_2, P_4, P_1$