1. **A computer has four page frames. The time of loading, time of last access, and the R and M bits for each page are as shown below (the times are in clock ticks)**

   (a) **Which page will NRU replace?**
       Page 0 R=0, M=0 優先被替換
   (b) **Which page will FIFO replace?**
       P2 最早被 load 進，所以優先被替換
   (c) **Which page will LRU replace?**
       P1 的最後使用時間最遠，所以優先被替換
   (d) **Which page will second chance replace?**
       FIFO-> P2 , but R=1 放到最後並將 R 改成 0
       Next FIFO-> P0 R=0 所以替換 P0

2. **A small computer has 8 pages frames each containing a page. The page frames contain virtual pages A,C,G,H,B,L,N,D in that order. Their respective load times were 18,23,5,7,32,19,3,8. Their reference bits are 1,0,1,1,0,1,1,0 and their modified bits are 1,1,1,0,0,0,1,1, respectively. Which page will the second chance page replacement algorithm replace?**

   FIFO->N , change R->0
   FIFO->G, change R->0
   FIFO->H, change R->0
   FIFO->D, 替換

3. **What is the difference between a physical address and a virtual address?**

   Physical Address 位址不能改變，Virtual address 為 OS 可看見的位置，可以比實際記憶體大，並透過 Memory management unit 將 Virtual address 對應到 Physical address.

4. **Are there any circumstances in which clock and second chance choose different pages to replace? If so, what are they?**

   當 page fault 發生時，需要做 page replace。Second chance 會使用 FIFO 來找，而 clock 只會從 circular list 的指標開始搜尋。

5. **A small computer has four page frames. At the first clock tick, the R bits are 0111 . At the subsequent clock ticks, the values are 1011,1010,1101,0010,1010,1100,0001. If the aging algorithm is used with an 8-bit counter, give the values of the four counters after the last ticks.**

R bits	page1	page2	page3	page4
0111	00000000	10000000	10000000	10000000
1011	10000000	01000000	11000000	11000000
1010	11000000	00100000	11100000	01100000
1101	11100000	10010000	01110000	10110000
0010	01110000	01001000	10111000	01011000
1010	10111000	00100100	11011100	00101100
1100	11011100	10010010	01101110	00010110
0001	01101110	01001001	00110111	10001011