1.

• Hardware Requirements: Maintain reference bits with each page. – On each access to the page, the hardware sets the reference bit to '1'. – Set to 0 at varying times depending on the page replacement algorithm. • Additional-Reference-Bits: Maintain more than 1 bit, say 8 bits. – On reference, set high bit to 1 – At regular intervals or on each memory access, shift the byte right, placing a 0 in the high order bit. – On a page fault, the lowest numbered page is kicked out. => Approximate, since it does not guarantee a total order on the pages. => Faster, since setting a single bit on each memory access. • Page fault still requires a search through all the pages.

2.use working set model to predict the process needed page in different running term , so we can meet the needed of page , to prevent trashing

3

Fifo

4 4 4 3 3 3 4 4 4

7 7 7 4 4 4 3 3

3 3 3 5 5 5 7

Opt

4 4 4 4 4 5 4 4 4

7 7 7 7 7 7 7 7

3 3 3 3 3 3 3

LRU

4 4 4 4 4 4 4 4 4

7 7 7 7 5 5 5 7

3 3 3 3 3 3 3

LFU

4 4 4 4 4 4 4 4 7

7 7 7 7 5 5 5 5

3 3 3 3 3 3 3