CSE 312 / 504 Operating Systems HW 3 Report

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Page Table

Frame Number	Present	Reference	Modified	Used Time	Load Time

Frame Number represents the page will replace to which page frame in physical memory.

Present represents the page currently is in the physical memory or not.

Reference represents the page is used after clock ınterrupt.

Modified represents the value of the page is modified.

Used time represents when was the page last used.

Load time represents when was the page is loaded to physical memory.

Implementation of the page table entry struct is started from 36th line at memory.h file.

```
36  struct PageTableEntry{
37      int present;
38      int reference;
39      int modified;
40      int frameNumber;
41      unsigned int usedTime;
42      unsigned int loadTime;
43  };
```

Implementations Details

Get Method:

Firstly page table is checked for given index exists in physical memory. If given index exists in physical table, the corresponding physical address is returned. If given index does not exist in physical table, then pageFault method is called.

In pageFault method, firstly physical memory is checked for are there any unused page frames. If there are, then the page frame of given index readed from virtual memory to first empty page frame on the physical memory and the corresponding physical address is returned.

If there are not any available page frames, current page replacement method is called. Page replacement method finds the proper page frame to change and if it is modified, save the page frame to virtual memory, then return the page frame number to change.

Then given index readed from virtual memory to choosen page frame.

Set Method:

Firstly page table is checked for given index exists in physical memory. If given index exists in physical table, value at the index is modified and the method ends.

If given index does not exist in physical table, physical memory is checked for are there any unused page frames. If there are, first available page frame number is saved to page table and new data is written to the page frame in physical memory. **(This part is only used for fill virtual memory).**

If there are not any available page frames, pageFault method is called. In pageFault method, current page replacement method is called. Page replacement method finds the proper page frame to change and if it is modified, save the page frame to virtual memory, then return the page frame number to change.

Then given index is readed from virtual memory to chosen page frame. At the end value at the index is modified and the method ends.

NRU Replacement:

Reference and modified datas are used for choosing the proper page to replace. Page table is traversed and trying to find most proper page for replacement.

If there are a page with both reference and modified datas are 0, it is chosen.

If not, then if there are a page with reference is 0 and modified is 1, it is chosen.

If not, then if there are a page with reference is 1 and modified is 0, it is chosen.

If not, then first page with both reference and modified datas are 0 is chosen.

For reset the reference datas in specific clock time, I used an unsigned integer which is increased whenever get or set method is used. And define a clock time which is 40 right now. When this data % 40 is given 0, the reference datas of the all pages is reseted to 0.

FIFO Replacement:

Load time data is used for fifo replacement. All pages are traversed and trying to find the page with lowest load time value.

I used an unsigned integer data for represents clock time. Whenever a transfer between virtual memory to physical memory is occurs, this data is increased.

SC Replacement:

Load time and reference datas are used for SC replacement. All pages are traversed (traverse can happen more than one times) and trying to find the page with 0 reference value and lowest load time. If reference data of the page with lowest load time is 1, it is decreased to 0 and the load time of the page is updated. Then the traverse is repeated until the find the page with 0 reference value and lowest load time.

LRU Replacement

Used time data is used for LRU replacement. All pages are traversed and trying to find the page with lowest used time data.

I used an unsigned integer data for represents clock time. Whenever get or set method is called, this data is increased.

WSClocking Replacement

Modified and used time data are used for WSClocking replacement. And I define a variable for represents the age, which is used for choose the proper page. If difference between current time(which I used at LRU replacement) and used time of the page bigger than the variable, the page can change. **(The Condition)**

All pages are traversed (traverse can happen more than once), firstly a page which is not modified and provides The Condition is looked. If it can not be found, a page provides The Condition is chosen.