

# CSE 2005

## OPERATING SYSTEMS



**Lab FAT, 8 June 2021**

L7+L8 | PLBG17

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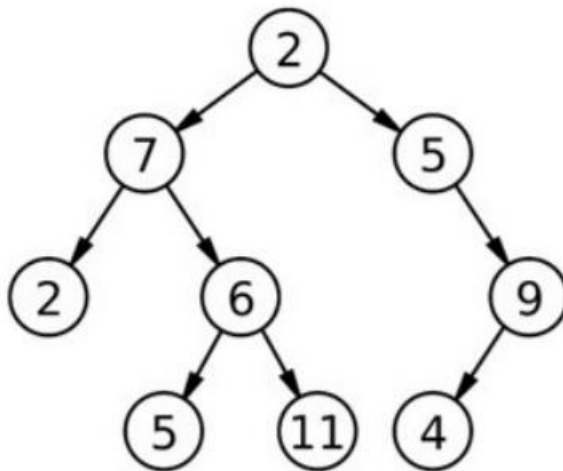
by

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### Questions

1. A. Write a Multiprocess application where the parent process initiates the child process. The parent process creates the binary tree as like below.



The child process does the task of finding the sum for the boundary nodes and returns the answer to the parent process. (10)

- b. Write a program that translates logical to physical addresses for a virtual address space of size  $2^{16} = 65,536$  bytes. Your program will read logical addresses from a file and translate each logical address to its corresponding physical address and output the value of the byte stored at the translated physical address.

Specifications are given below

# $2^8$  entries in the page table

# Page size of  $2^8$  bytes •

#Frame size of  $2^8$  bytes

#256 frames

Write it using C language (15)

### Solution\_a

```

#include <stdio.h>
#include <sys/types.h>
#include <unistd.h>

int main() {
    int pipefds[2];
    int returnstatus;
    returnstatus=pipe(pipefds);
    int writeval=0;
    int readval1=0, readval2=0;
    pid_t l1, r1;
    l1=fork();
    r1=fork();

    if(l1==0) {
        pid_t l2, r2;
        l2=fork();
    }
}

```

```

        r2=fork();
        if(l2==0){

        }
        if(r2==0){
            pid_t l3,r3;
            l3=fork();
            r3=fork();

            if(l3==0){
                writeval=5;
                write(pipefds[1],writeval,sizeof(int));
            }
            read(pipefds[0],readval1,sizeof(int));
            if(r3==0){
                writeval=11;
                write(pipefds[1],writeval,sizeof(int));
            }
            read(pipefds[0],readval2,sizeof(int));
            printf("Sum of child with value 6 is: %d\n",readval1+readval2);

        }
    }
    if(r1==0){
        pid_t r2;
        if(r2==0){
            pid_t l3;
            if(l3==0){
                }
            }
        }
    }

    return 0;
}

```

## OUTPUT:

```

shara-d@Rohans-Workstation: /mnt/c/Users/shara/OS
Virtual Address : 12107 and Physical Address : 2635 with Value : 210

Page-fault rate is : 24.40 %
TLB-hit rate is : 5.40 %
shara-d@Rohans-Workstation:/mnt/c/Users/shara/OS$ gcc -o 1a 1a.c
shara-d@Rohans-Workstation:/mnt/c/Users/shara/OS$ ./1a

Program to implement Binary Tree operations

MENU
1. CREATE
2. SUM
3. EXIT
Enter your choice: 1
Entering data for root node...
Enter the data: 1
Do you want to enter data in left child of 1: 2
Do you want to enter data in right child of 1: 2

MENU
1. CREATE
2. SUM
3. EXIT
Enter your choice: 2
Sum of boundary nodes is : 1

MENU
1. CREATE
2. SUM
3. EXIT
Enter your choice: 1
Entering data for root node...
Enter the data: 7
Do you want to enter data in left child of 7: 2
Do you want to enter data in right child of 7: 3

MENU
1. CREATE
2. SUM
3. EXIT
Enter your choice: 3

```

## Solution\_b

```
#include<stdio.h>
#include <stdlib.h>

int TLB[16][2];
int TLBsize = 0;

int pageTable[256];

int memoryFull = 0;
int memory[256][256];

void pageFault(int pageNum) {
    FILE *ptr = fopen("BACKING_STORE.bin", "rb");

    if (ptr == NULL) {
        printf("Couldn't open the file! \n");
        return;
    }

    if (fseek(ptr, 256*pageNum, SEEK_SET) != 0) {
        printf("Page not found!\n");
        return;
    }

    unsigned char buffer[256];
    fread(buffer, sizeof(buffer), 1, ptr); // read 10 bytes to our buffer

    for(int i=0; i<256; i++){
        memory[memoryFull][i] = buffer[i];
    }

    pageTable[pageNum] = memoryFull;
    memoryFull++;

    fclose(ptr);
}

int main(int argc, char* argv[])
{
    if(argc==1)
        printf("No File name is passed in Command Line.\n");
    if(argc>=2)
    {
        char *fileName = argv[1];
        FILE *fp = fopen(fileName, "r");

        if (fp == NULL)
        {
            printf("Couldn't open the file! \n");
            return -1;
        }

        int logicalAddress;
        int pageFaultStat = 0, TLBstat = 0;
        int totalAccess = 0;

        for(int i=0; i<256; i++){
            pageTable[i] = -1;
        }
    }
}
```

```
while(fscanf(fp, "%d", &logicalAddress) != EOF){
    totalAccess++;

    int pageNumMask = 0, offsetMask = 0;
    for(int i=0; i<8; i++){
        offsetMask |= 1 << i;
        pageNumMask |= 1 << (i+8);
    }

    int pageNum = pageNumMask & logicalAddress;
    pageNum = pageNum >> 8;
    int offset = offsetMask & logicalAddress;

    int TLBhit = 0;

    for(int i=0; i<TLBsize; i++){
        if(TLB[i][0] == pageNum){
            TLBhit = 1;
            int valueOfAdd = memory[TLB[i][1]][offset];
            int physicalAddress = TLB[i][1]*256 + offset;
            printf("Virtual Address : %d and Physical Address : %d with Value : %d\n", logicalAddress, physicalAddress, valueOfAdd);
            TLBstat++;
            break;
        }
    }

    if (TLBhit == 0){
        if(pageTable[pageNum] == -1){
            pageFault(pageNum);
            pageFaultStat++;
        }
        int valueOfAdd = memory[pageTable[pageNum]][offset];
        int physicalAddress = pageTable[pageNum]*256 + offset;
        printf("Virtual Address : %d and Physical Address : %d with Value : %d \n", logicalAddress, physicalAddress, valueOfAdd);

        if(TLBsize != 16){
            TLB[TLBsize][0] = pageNum;
            TLB[TLBsize][1] = pageTable[pageNum];
            TLBsize++;
        }
        else{
            for(int i=0; i<15; i++){
                TLB[i][0] = TLB[i+1][0];
                TLB[i][1] = TLB[i+1][1];
            }
            TLB[15][0] = pageNum;
            TLB[15][1] = pageTable[pageNum];
        }
    }
}

printf("\n\nPage-fault rate is : %.2f %%\n", (1.0*pageFaultStat) / (1.0 * totalAccess) * 100.0);
printf("TLB-hit rate is : %.2f %%\n", (1.0*TLBstat) / (1.0 * totalAccess) * 100.0);

fclose(fp);
}
return 0;
}
```

## OUTPUT:

```
shara-d@Rohans-Workstation: /mnt/c/Users/shara/OS
shara-d@Rohans-Workstation:~$ cd /mnt/c/Users/shara/OS
shara-d@Rohans-Workstation: /mnt/c/Users/shara/OS$ gcc -o lb lb.c
shara-d@Rohans-Workstation: /mnt/c/Users/shara/OS$ ./lb addresses.txt
Virtual Address : 16916 and Physical Address : 20 with Value : 0
Virtual Address : 62493 and Physical Address : 285 with Value : 0
Virtual Address : 30198 and Physical Address : 758 with Value : 29
Virtual Address : 53683 and Physical Address : 947 with Value : 108
Virtual Address : 40185 and Physical Address : 1273 with Value : 0
Virtual Address : 28781 and Physical Address : 1389 with Value : 0
Virtual Address : 24462 and Physical Address : 1678 with Value : 23
Virtual Address : 48399 and Physical Address : 1807 with Value : 67
Virtual Address : 64815 and Physical Address : 2095 with Value : 75
Virtual Address : 19295 and Physical Address : 2423 with Value : 221
Virtual Address : 12218 and Physical Address : 2746 with Value : 11
Virtual Address : 22760 and Physical Address : 3048 with Value : 0
Virtual Address : 57982 and Physical Address : 3198 with Value : 56
Virtual Address : 27966 and Physical Address : 3390 with Value : 27
Virtual Address : 54894 and Physical Address : 3694 with Value : 53
Virtual Address : 38929 and Physical Address : 3857 with Value : 0
Virtual Address : 32865 and Physical Address : 4193 with Value : 0
Virtual Address : 64243 and Physical Address : 4595 with Value : 188
Virtual Address : 2315 and Physical Address : 4619 with Value : 66
Virtual Address : 64454 and Physical Address : 5062 with Value : 62
Virtual Address : 59041 and Physical Address : 5121 with Value : 0
Virtual Address : 18633 and Physical Address : 5577 with Value : 0
Virtual Address : 14557 and Physical Address : 5853 with Value : 0
Virtual Address : 61006 and Physical Address : 5966 with Value : 59
Virtual Address : 62615 and Physical Address : 407 with Value : 37
Virtual Address : 7591 and Physical Address : 6314 with Value : 105
Virtual Address : 64747 and Physical Address : 6635 with Value : 58
Virtual Address : 6727 and Physical Address : 6727 with Value : 145
Virtual Address : 32315 and Physical Address : 6971 with Value : 142
Virtual Address : 60645 and Physical Address : 7397 with Value : 0
Virtual Address : 6308 and Physical Address : 7588 with Value : 0
Virtual Address : 45688 and Physical Address : 7800 with Value : 0
Virtual Address : 969 and Physical Address : 8137 with Value : 0
Virtual Address : 40891 and Physical Address : 8379 with Value : 238
Virtual Address : 49294 and Physical Address : 8590 with Value : 48
Virtual Address : 41118 and Physical Address : 8862 with Value : 40
Virtual Address : 21395 and Physical Address : 9107 with Value : 228
Virtual Address : 6091 and Physical Address : 9419 with Value : 242
Virtual Address : 32541 and Physical Address : 9501 with Value : 0
Virtual Address : 17665 and Physical Address : 9729 with Value : 0
Virtual Address : 3784 and Physical Address : 10184 with Value : 0
Virtual Address : 28718 and Physical Address : 1326 with Value : 28
Virtual Address : 59240 and Physical Address : 10344 with Value : 0
Virtual Address : 40170 and Physical Address : 1266 with Value : 39
Virtual Address : 60086 and Physical Address : 10678 with Value : 58
Virtual Address : 42252 and Physical Address : 10764 with Value : 0
Virtual Address : 44770 and Physical Address : 11234 with Value : 43
```

...

```
shara-d@Rohans-Workstation: /mnt/c/Users/shara/OS
Virtual Address : 20634 and Physical Address : 56986 with Value : 20
Virtual Address : 57555 and Physical Address : 38099 with Value : 52
Virtual Address : 61210 and Physical Address : 42266 with Value : 59
Virtual Address : 269 and Physical Address : 57101 with Value : 0
Virtual Address : 33154 and Physical Address : 53634 with Value : 32
Virtual Address : 64487 and Physical Address : 5095 with Value : 249
Virtual Address : 61223 and Physical Address : 42279 with Value : 201
Virtual Address : 47292 and Physical Address : 29884 with Value : 0
Virtual Address : 21852 and Physical Address : 24156 with Value : 0
Virtual Address : 5281 and Physical Address : 15265 with Value : 0
Virtual Address : 45912 and Physical Address : 51032 with Value : 0
Virtual Address : 32532 and Physical Address : 3492 with Value : 0
Virtual Address : 63067 and Physical Address : 22107 with Value : 150
Virtual Address : 41683 and Physical Address : 41939 with Value : 180
Virtual Address : 20981 and Physical Address : 39157 with Value : 0
Virtual Address : 33881 and Physical Address : 42073 with Value : 0
Virtual Address : 41785 and Physical Address : 38713 with Value : 0
Virtual Address : 4580 and Physical Address : 58852 with Value : 0
Virtual Address : 41389 and Physical Address : 25005 with Value : 0
Virtual Address : 28572 and Physical Address : 28060 with Value : 0
Virtual Address : 782 and Physical Address : 7950 with Value : 0
Virtual Address : 30273 and Physical Address : 58045 with Value : 0
Virtual Address : 62267 and Physical Address : 23867 with Value : 206
Virtual Address : 17922 and Physical Address : 18690 with Value : 17
Virtual Address : 63238 and Physical Address : 16902 with Value : 61
Virtual Address : 3308 and Physical Address : 40428 with Value : 0
Virtual Address : 26545 and Physical Address : 24497 with Value : 0
Virtual Address : 44395 and Physical Address : 44907 with Value : 90
Virtual Address : 39120 and Physical Address : 4048 with Value : 0
Virtual Address : 21706 and Physical Address : 52426 with Value : 21
Virtual Address : 7144 and Physical Address : 26600 with Value : 0
Virtual Address : 30244 and Physical Address : 58916 with Value : 0
Virtual Address : 3725 and Physical Address : 10125 with Value : 0
Virtual Address : 54632 and Physical Address : 48744 with Value : 0
Virtual Address : 30574 and Physical Address : 16238 with Value : 29
Virtual Address : 8473 and Physical Address : 19993 with Value : 0
Virtual Address : 12386 and Physical Address : 45154 with Value : 12
Virtual Address : 41114 and Physical Address : 8858 with Value : 40
Virtual Address : 57930 and Physical Address : 3146 with Value : 56
Virtual Address : 15341 and Physical Address : 32493 with Value : 0
Virtual Address : 15598 and Physical Address : 31982 with Value : 15
Virtual Address : 59922 and Physical Address : 10514 with Value : 58
Virtual Address : 18226 and Physical Address : 2354 with Value : 17
Virtual Address : 48162 and Physical Address : 17698 with Value : 47
Virtual Address : 41250 and Physical Address : 24866 with Value : 40
Virtual Address : 1512 and Physical Address : 51688 with Value : 0
Virtual Address : 2546 and Physical Address : 4890 with Value : 2
Virtual Address : 41682 and Physical Address : 41938 with Value : 40
Virtual Address : 312 and Physical Address : 57154 with Value : 0
Virtual Address : 880 and Physical Address : 8008 with Value : 0
```

...

```
shara-d@Rohans-Workstation: /mnt/c/Users/shara/OS
Virtual Address : 47706 and Physical Address : 56410 with Value : 46
Virtual Address : 43973 and Physical Address : 57541 with Value : 0
Virtual Address : 42088 and Physical Address : 46104 with Value : 0
Virtual Address : 27460 and Physical Address : 15684 with Value : 0
Virtual Address : 24990 and Physical Address : 52647 with Value : 105
Virtual Address : 51933 and Physical Address : 27357 with Value : 0
Virtual Address : 34070 and Physical Address : 60950 with Value : 33
Virtual Address : 65155 and Physical Address : 48515 with Value : 160
Virtual Address : 59955 and Physical Address : 10547 with Value : 140
Virtual Address : 9277 and Physical Address : 22845 with Value : 0
Virtual Address : 20420 and Physical Address : 16836 with Value : 0
Virtual Address : 44860 and Physical Address : 13116 with Value : 0
Virtual Address : 50992 and Physical Address : 42800 with Value : 0
Virtual Address : 10583 and Physical Address : 27479 with Value : 85
Virtual Address : 57751 and Physical Address : 61335 with Value : 101
Virtual Address : 23195 and Physical Address : 35995 with Value : 166
Virtual Address : 27227 and Physical Address : 28763 with Value : 150
Virtual Address : 42816 and Physical Address : 19520 with Value : 0
Virtual Address : 58219 and Physical Address : 34155 with Value : 218
Virtual Address : 37606 and Physical Address : 21478 with Value : 36
Virtual Address : 18426 and Physical Address : 2554 with Value : 17
Virtual Address : 21238 and Physical Address : 37878 with Value : 20
Virtual Address : 11983 and Physical Address : 59855 with Value : 179
Virtual Address : 48394 and Physical Address : 1802 with Value : 47
Virtual Address : 11036 and Physical Address : 39964 with Value : 0
Virtual Address : 30557 and Physical Address : 16221 with Value : 0
Virtual Address : 23453 and Physical Address : 20637 with Value : 0
Virtual Address : 49847 and Physical Address : 31671 with Value : 173
Virtual Address : 30032 and Physical Address : 592 with Value : 0
Virtual Address : 48065 and Physical Address : 25793 with Value : 0
Virtual Address : 6957 and Physical Address : 26413 with Value : 0
Virtual Address : 2301 and Physical Address : 35325 with Value : 0
Virtual Address : 7736 and Physical Address : 57912 with Value : 0
Virtual Address : 31260 and Physical Address : 23324 with Value : 0
Virtual Address : 17071 and Physical Address : 175 with Value : 171
Virtual Address : 8940 and Physical Address : 46572 with Value : 0
Virtual Address : 9929 and Physical Address : 44745 with Value : 0
Virtual Address : 45563 and Physical Address : 46075 with Value : 126
Virtual Address : 12107 and Physical Address : 2635 with Value : 210
```

Page-fault rate is : 24.40 %

TLB-hit rate is : 5.40 %

shara-d@Rohans-Workstation: /mnt/c/Users/shara/OS\$