

CMPS111-HW5

Jinxuan Jiang

Question 1

virtual addresses = 48 bit

physical addresses = 32 bit

virtual address space size = 2^{48} B

Given Page size = 8 KB = 2^{13} B

so Offset is = 13 bits

Number of entries in page table = (virtual address space size)/(page size)

so number of virtual pages = $2^{(48 - 13)} = 2^{35}$

and number of entries in page table = number of virtual pages

number of entries in page table = 2^{35}

number of linear page table entries required = $2^{35} = 34359738368$

Question 2

If x is 0, we have a deadlock immediately. If x is 1, process D can run to completion. When it is finished, the available vector is 1 1 2 2 1. Now A can run to complete, the available vector then becomes 2 1 4 3 2. Then C can run and finish, return the available vector as 3 2 4 4 2. Then B can run to complete. Safe sequence D A C B.

Question 3

With the kernel threads, a thread can block on a semaphore and the kernel can run some other thread in the same process. Consequently, there is no problem using semaphores.

With user-level threads, when one thread blocks on a semaphore, the kernel thinks the entire process is blocked and does not run it ever again. Consequently, the process fails.

Question 4

Multiprogramming without DMA:

- Multiprogramming is a special feature in Operating system where a computer holds several programs and runs them at the same time (or) parallel processing. When CPU allows multiple programs to run at the same time, all the programs should run in sequence resulting in creating a backup for all programs. A program is handled by the CPU execution only after its I/O Completion.
- When there is no DMA(Direct Memory Access) to control the flow of bits between a memory and controller without any CPU actions, the CPU is busy in performing the I/O operations.
- Thus, as the CPU is busy in performing the I/O operations there is no use of multiprogramming resulting in no parallel processing.

Trap instruction:

Trap is an un-programmed conditional jump to a specified address in a Kernel that is detected by the CPU.

It is a software interrupt which switches from User mode to Kernel mode.

The Trap instruction associates with the execution of current instruction by the CPU. When the exception is fatal, the current instruction or process is suspended (or) moves to Exit state. Thus, switching from user mode to kernel mode is necessary.

Examples:

- Illegal operation code
- Division instruction with a zero divisor etc.

Use In operating system:

The trap instruction handles an error or exception condition in a program.

Question 5

1.) Using 3 frames

1	2	3	4	1	2	5	1	2	3	4	5
1	1	1	4	4	4	5	5	5	5	5	5
	2	2	2	1	1	1	1	1	3	3	3
		3	3	3	2	2	2	2	2	4	4
x	x	x	x	x	x	x			x	x	

Total page fault = 9

2.) Using 4 frames

1	2	3	4	1	2	5	1	2	3	4	5
1	1	1	1	1	1	5	5	5	5	4	4
	2	2	2	2	2	2	1	1	1	1	5
		3	3	3	3	3	3	2	2	2	2
			4	4	4	4	4	4	3	3	3
x	x	x	x			x	x	x	x	x	x

Total page fault = 10

When number of page frames increase from three to four then number of page faults go down