

CIT 5950 Recitation 7 - Scheduling & Virtual Memory

Welcome back to recitation! We're glad that you're here :)

Exercise 1 - Scheduling

Consider the following set of tasks/processes:

Name	Arrival Time	Running Time
Bert	2	11
Ernie	0	8
Oscar	12	20
Grover	7	15
Elmo	10	4

- a) Using the **Round Robin** scheduling algorithm and a time slice of **8**, what is the finishing time for each?

Name	Finishing Time
Bert	
Ernie	
Oscar	
Grover	
Elmo	

- b) What is the **average waiting time**?

VM Calculations Cheat Sheet

Address space = $2^{\text{(# bits in the address, e.g. 64 for 64-bit machine)}}$

Size of virtual memory = Address space * Addressability (# Bytes in each address)

Number of pages = Size of virtual memory / size of a page

Size of a page = size of a frame

Number of frames = Physical Memory (RAM) space / size of a frame

Number of bits to represent pages or frames = Log_2 (number of pages or frames)

Page number = first N bits of the virtual address, N = number of bits to represent pages or frames

1 KB = 2^{10} B

1 MB = 2^{20} B

1 GB = 2^{30} B

Question #2

Consider a system as follows:

- 32-bit address space
- 16-bit addressable
- 1GB of physical memory
- page sizes of 64kB

- a) How many **pages** are there in virtual memory? Express your answer as a power of 2
- b) How many **frames** are there in physical memory?
- c) How many **bits** are there in each address' page number?
- d) Consider the virtual address xABCDEF01. What is its **page number** in hexadecimal?

Question #3

We are working with a byte-addressable system that has a 16-bit address space, 32kB of physical memory, and page sizes of 8kB. Assume the page table is initially empty, and then a process generates the following sequence of virtual addresses:

x3311
x1234
x1255
x3456
xA349
x7777
xB222
x6222

- If virtual address $x5324$ is requested next, which page will be evicted if using a First In First Out (FIFO) replacement algorithm? State the page number.
- Instead of using FIFO, which page will be evicted if using a Least Recently Used (LRU) replacement algorithm? State the page number.
- Rather than using FIFO or LRU, imagine that the system could look into the future and see that the next four virtual address requests (after $x5324$) would be as follows:

x1A23
x399A
x7282
x4A32

Knowing this information, which page should be evicted when the request for $x5324$ generates a page fault?