This homework is due on May 14, 2019 at 6pm in class.

Page size = frame size
Logical address space (size) = 2^m
Physical address space (size) = 2^x (where x is the number of bits in physical address)
Logical address space (size) = # of pages × page size
Physical address space (size) = # of frames × frame size
Page size= frame size= 2^n
Of pages= 2^{m-n}
Of entries (records) in page table = # of pages

Question 1
Consider a computer system with a 32-bit logical address and 4-KB page size. The system supports up to 512 MB of physical memory. How many entries are there in each of the following?

- A conventional single-level page table.

  # of pages= # of entries = ?
  Size of logical address space = 2^m = # of pages × page size
  2^{32} = # of pages × 2^{12}
  # Of pages =2^{32} / 2^{12}= 2^{20} pages

Question 2
Consider a logical address space of 256 pages with a 4-KB page size, mapped onto a physical memory of 64 frames.

a. How many bits are required in the logical address?

Method 1

Logical address space (/size) = 2^m
Logical address space (/size) = # of pages × page size
Logical address space (/size) = 256 × 4 KB
Logical address space (/size) = 256 × 4096
Logical address space (/size) = 1048576
Logical address space (/size) = 2^{20}
m = 20 (Answer)

Method 2

Page size = 2^n
4096 = 2^{12}
n = 12

# of pages = 2^{m-n}
256 = 2^{m-12}
$2^8 = 2^{m-12}$
$2^{8+12=}$ 2^m

m = 20

b. How many bits are required in the physical address?

Let x be the number of physical addresses

Physical address space (/size) = 2^x

Physical address space (size) = # of frames × frame size

Physical address space (size) = 64 × 4 KB

Physical address space (size) = 64 × 4096

Physical address space (size) = $2^6 \times 2^{12} = 2^{18}$

Number of required bits in the physical address=x =18 bit

Question 3

Assuming a 1-KB page size, what are the page numbers and offsets for the following address references (provided as decimal numbers):

a. 3085
b. 42095
c. 215201
d. 650000
e. 2000001

Answer size = 2^n = 1KB = 1024 = 2^{10}

# of bits in offset part (n) =10

Solution steps:

1. Convert logical address: Decimal to Binary
2. Split binary address to 2 parts (page #, Offset), offset: n digits
3. Convert offset & page #: Binary to Decimal

a. 3085

Decimal = 3085

Binary = 0000001100000001101

Page # = 011 = 3

Page offset = 0000001101 = 13

b. 42095

Decimal = 42095

Binary = 1010010001101111

Page # = 101001 = 41

Page offset = 0001101111 = 111

c. 215201

Decimal = 215201

Binary = 110100100010100001

Page # = 11010010 = 210

Page Offset 0010100001 = 161

d. 650000

Decimal: 650000
Binary: 10011110101100010000
Page #: 1001111010 = 634
Page Offset: 1100010000 = 784

e. 2000001

Decimal
Binary: 111101000010010000001
Page # = 11110100001 = 1953
Page Offset: 0010000001 = 129

Question 4
What is the purpose of paging the page tables?

Question 5
Suppose that a disk drive has 5,000 cylinders, numbered 0 to 4,999. The drive is currently serving a request at cylinder 2,150, and the previous request was at cylinder 1,805. The queue of pending requests, in FIFO order, is:
2,069, 1,212, 2,296, 2,800, 544, 1,618, 356, 1,523, 4,965, 3681

Starting from the current head position, what is the total distance (in cylinders) that the disk arm moves to satisfy all the pending requests for each of the following disk-scheduling algorithms?
a. FCFS
b. SSTF
c. SCAN
e. C-SCAN