


# National University of Computer and Emerging Sciences, Lahore Campus

	Course Name:	Computer Architecture	Course Code:	EE204
	Program:	BS(Computer Science)	Semester:	FALL 2020
	Sections	B		
	Due Date:	17-12-2020 03:30 pm	Weight	~2
	Exam Type:	Assignment 7	Page(s):	3

**Student : Name:** \_\_\_\_\_ **Roll No.** \_\_\_\_\_  
**Section:** \_\_\_\_\_

## Question 1 [10]

We have studied that if our physical memory is not enough than we can expand it using the concept of virtual memory. However, another usage of Virtual memory is that we can restrict certain processes to only access a specific portion of memory.

In this problem, we have a physical memory of 4 MB, however we want to give access of 256 bytes to each process so the virtual address is 8 bits only. Page size is 16 bytes. Following figures shows a small portion of our physical memory and page table for address translation (**All values and addresses are in hexadecimal**).

Physical Address	Data (bytes)																Page Table:	
																	VPN	PPN
080	2A	1B	0C	3D	5A	02	13	12	22	13	4A	0B	10	21	21	12	0	08
090	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	1	09
0A0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	2	0A
0B0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	3	0B
0C0	02	1B	A1	2C	11	31	22	33	11	12	14	2B	11	2B	15	13	4	0C
0D0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	5	0D
0E0	02	01	03	04	11	01	01	0B	11	10	12	13	00	03	11	0B	6	0E
0F0	00	00	01	10	00	00	00	00	00	00	00	00	00	00	00	00	7	0F
100	1A	2B	3C	4D	5E	01	10	02	20	03	40	0A	11	22	01	10	8	10
110	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	9	11
120	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	A	12
130	01	1A	A0	2B	10	21	12	13	01	02	04	2A	01	1B	02	03	B	13
140	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	C	14
150	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	D	15
160	01	01	02	03	10	01	02	0A	10	11	02	03	00	02	10	0A	E	16
170	01	02	02	01	01	02	03	04	00	00	00	00	00	00	00	00	F	17

**Answer the following questions:**

Q1: What is the physical address corresponding to virtual address number 14 (decimal)?

Q2: What is the data byte value at virtual address 0xB5 (Hex)?

Q3: What is the 4 byte word value at virtual address 0x94 (Hex)? Values are stored in memory using little endian format.

Q4: If a specific process requires 2 K bytes of memory then how can we assign such a block to that process? What changes would be required?

**Show complete working to get credit for your answers.**

## **Question 2 [10]**

Assuming a cache of 512 blocks, a 64 bytes block size, and a 24-bit memory address.

1. The total number of sets for a direct-map cache: \_\_\_\_\_
  
2. The total number of sets for an 8-way set associate cache: \_\_\_\_\_
  
3. How many total bits of storage(tag+data +valid) are required for an 8-way set associate cache:  
\_\_\_\_\_
  
4. How many total bits of storage(tag+data +valid) are required for a fully associative cache:  
\_\_\_\_\_
  
5. In case of an 8-way set associate cache, Into what set would bytes with each of the following addresses be stored  

	<b>Set number (decimal)</b>
▪ 0001 0001 0001 1011 1111 0101	
▪ 1100 1111 0011 0011 0100 1001	