# THE UNIVERSITY OF ZAMBIA
## School of Natural Sciences
## Department of Computer Science

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## CSC 2111 – COMPUTER ARCHITECTURE

## 2015/2016 FINAL EXAM

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|---|---|---|
| Date | : | Wednesday 8th June 2016 |
| Venue | : | B512 |
| Time | : | 09:00 – 12:00 hrs |
| Duration | : | 3 Hours |

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## Instructions

1. This exam has 6 questions.
2. Answer any **five (5)** questions.
3. Write your answers on the answer sheet provided.

## QUESTION 1 [20 marks]

1. What, in general terms, is the distinction between computer organization and computer architecture? You may cite examples. **[4 marks]**
2. Draw a diagram showing the structural components of a central processing unit. **[4 marks]**
3. What is the key distinguishing feature of a microprocessor? **[1 mark]**
4. At the integrated circuit level, give the three principal constituents of a computer system and state their function? **[3 marks]**
5. Convert the following hexadecimal numbers to their binary equivalents: **[4 marks]**
   a. EF
   b. 45
6. Convert the following binary numbers to their hexadecimal equivalents: **[4 marks]**
   a. 1101 1010
   b. 10 0011

## QUESTION 2 [20 marks]

1. State and explain 2 classes of interrupts. **[4 marks]**
2. What is the control bus in a computer's organization and architecture? **[2 marks]**
3. List 2 elements of bus design that serve to classify buses and give their sub parameters. **[4 marks]**
4. A CPU contains a number of registers that assist in the execution of instructions. Explain what role the following register's play: **[6 marks]**
   a. PC,
   b. IR,
   c. MAR,
   d. MBR,
   e. I/O AR, and
   f. I/O BR
5. List and explain 2 key characteristics of computer memory systems. **[4 marks]**

## QUESTION 3 [20 marks]

1. What are the differences among sequential access, direct access, and random access? **[6 marks]**

2. What is the general relationship among access time, memory cost, and capacity? **[3 marks]** low accesstime - expensive
   high capacity - cheaper
   high capacity gives low access time

3. Explain what write-through and write-back are giving the potential problems for each of these policies. **[4 marks]** write through both main-memory and cache are updated traffic
   write back only cache is updated-

4. Define unified cache and split cache. **[4 marks]**
   Unified cache is a single cache

5. Given the following values calculate the capacity of the disk. (Answer should be in GB) **[3 marks]**
   - 1024 bytes/sector
   - 100 sectors/track (on average)
   - 10,000 tracks/surface
   - 2 surfaces/platter
   - 10 platters

## QUESTION 4 [20 marks]

1. Give 2 key properties of semiconductor memory? **[2 marks]**
   exhibit stable or semi-stable states
   can be written into atleast once

2. What is the difference between DRAM and SRAM
   a. in terms of application and SRAM - cache DRAM - main memory
   b. in terms of characteristics such as speed, size, and cost? **[4 marks]**
      SRAM is faster SRAM is more expensive
      DRAM is smaller

3. What is the difference between EPROM and EEPROM **[7 marks]**
   EPROM uses uv

4. What is a parity bit? **[1 marks]**

5. Given the following 8-bit word 0011 1101, calculate the 4-bit hamming code needed for error detection. Show what the new 12-bit word will be stored as. **[6 marks]**

EPROM

* you erase all contents before writing into it
* uses ultraviolet light
* is denser

EEPROM

* you dont erase all the contents
* uses electrical charge
* less dess
* faster

**QUESTION 5 [20 marks]**

1. Give 4 advantages of using a glass substrate for a magnetic disk? **[4 marks]**
   - withstand shock or damage
   - uniform surface
   - ability to fly
2. Define the terms track, cylinder, and sector on a magnetic disk. **[3 marks]**
3. What common characteristics are shared by all RAID levels? **[3 marks]**
   * striping data is distributed acr. all blocks
   * the operating system sees them as a single physical disk.
   * they all store parity info
4. How is redundancy achieved in a RAID system? **[2 marks]**
   By duplication as in RAID level 1 and through parity bits as in RAID levels 2-6
5. In the context of RAID, what is the distinction between parallel access and independent access? **[4 marks]** parallel access all of the blocks are checked while independent checks all the blocks speed separately
6. The access time for retrieving a piece of data is defined as $T_{access} = T_{seek} + T_{rotational} + T_{transfer}$. Given the following information calculate the access time. **[4 marks]**
   - Rotational Rate = 7200 RPM
   - Average Seek Time = 10 ms
   - Average number of sectors per track = 1000

90 x 10 / 2200

**QUESTION 6 [20 marks]**

1. State and describe 4 types of optical disk products **[4 marks]**
   Compact Disk Rewritable
   Compact Disk Recordable
   Digital Versatile Disk Recordable
   Digital Versatile Disk Recordable
2. What is the difference between memory-mapped I/O and isolated I/O? **[4 marks]**
3. Give 4 major functions of an I/O module? **[4 marks]**
   Control and timing
   Communication
   Device communication
   Processor communication
4. When a DMA module takes control of a bus, and while it retains control of the bus, what does the processor do? **[1 mark]** The processor is not involved because this is a Direct access between memory and I/O mod
5. List and explain 3 ways a processor can use to determine which device issued the interrupt, when a device interrupt occurs? **[6 marks]**
   Bus arbitration
   multiple interrupts
   software polls
6. Assume a memory access to main memory on a cache "miss" takes 10 ns and a memory access to the cache on a cache "hit" takes 2 ns. If 80% of the processor's memory requests result in a cache "hit", what is the average memory access time? **[1 mark]**

RAID Level 1

RAID 2, 3, 4

**- END -**

Memory mapped
- no specific commands

I/O
- has specific commands
- does not look like read