THE UNIVERSITY OF ZAMBIA

School of Natural Sciences

Department of Computer Science

CSC2111 – COMPUTER ARCHITECTURE

2014/2015 FINAL EXAM

Date:	Monday 2nd March 2015
Venue:	Upper Dining Hall
Time:	09:00 – 12:00 hrs
Duration:	3 Hours

Instructions

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

QUESTION 1 [20 marks]

1. What, in general terms, is the distinction between computer organization and computer architecture? **[2 marks]**
2. Draw a diagram showing the components of a control unit. **[4 marks]**
3. What is a stored program computer? **[2 marks]**
4. At the integrated circuit level, give the three principal constituents of a computer system and state their function? **[6 marks]**
5. Convert the following hexadecimal numbers to their binary equivalents: **[3 marks]**
   a. D52 b. 239
6. Convert the following binary numbers to their hexadecimal equivalents: **[3 marks]**
   a. 00 1001 b. 1010 0111

QUESTION 2 [20 marks]

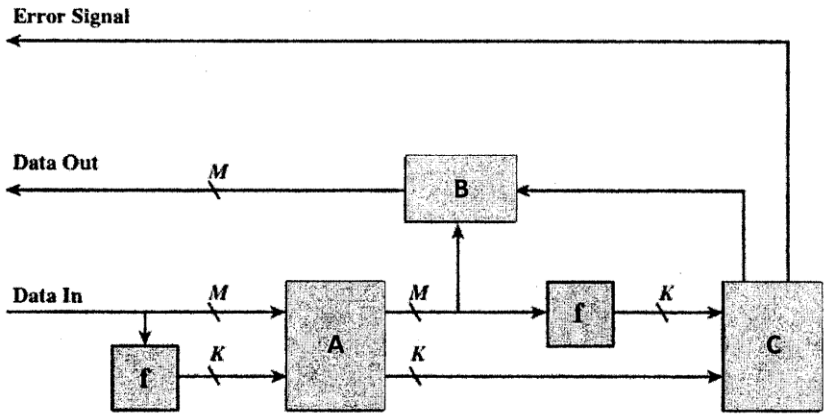
1. Give an example of embedded system and state its market. **[1 marks]**
2. What is a benchmark in computer science? Give an example. **[2 marks]**
3. State and explain the 2 classes of interrupts. **[2 marks]**
4. What is the control bus and what kind of signals can it transmit? **[4 marks]**
5. List the 3 elements of bus design that serve to classify buses and give their sub parameters **[6 marks]**
6. Consider a memory organization with a 16-bit memory addresses and word length of 4 bytes. What is the 2^{nd} byte number of the fifth last word #? **[5 marks]**

QUESTION 3 [20 marks]

1. Define the terms sequential access, direct access, and random access? **[3 marks]**
2. What is the general relationship among access time, memory cost, and capacity? **[2 marks]**
3. Draw a diagram showing a typical cache organization in relation to the processor and the system bus. **[5 marks]**
4. Cache is a component that stores instructions/data so that future requests for either can be served faster, list and explain 2 elements considered in the design of cache. **[4 marks]**
5. What is victim cache? **[1 mark]**
6. Explain what write-through and write-back are giving the potential problems for each
7. Define unified cache and spilt cache. **[2 marks]**
8. Given the following values calculate the capacity of the disk. (Answer should be in GB) **[3 marks]**
   - 512 bytes/sector
   - 300 sectors/track (on average)
   - 20,000 tracks/surface
   - 2 surfaces/platter
   - 5 platters

QUESTION 4 [20 marks]

1. Give 2 key properties of semiconductor memory? **[2 marks]**
2. What is the difference between DRAM and SRAM in terms of (a) application and in terms of (b) characteristics such as speed, size, and cost? **[4 marks]**
3. Explain why one type of RAM is considered to be analog and the other digital. **[4 marks]**
4. Give 3 applications for ROM? **[3 marks]**
5. The diagram below shows how error correction is normally set up in computers. If f represents the error correction function, label the components A, B and C **[3 marks]**



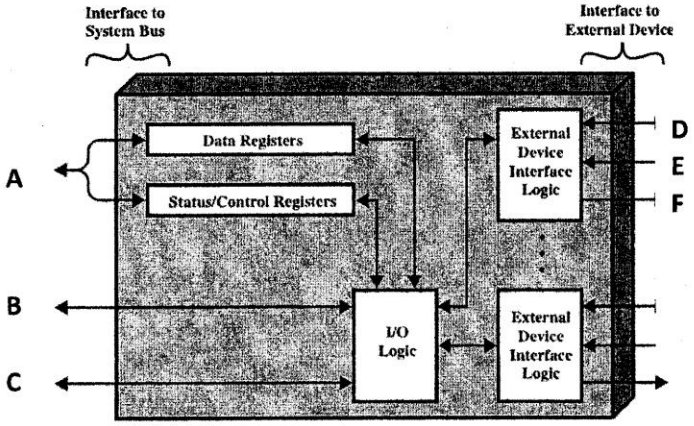
6. Given the 12-bit word 001101101111, composed of 8 data bits and 4 check bits, has an error, find in which position the error is in using a hamming code of 0111. **[4 marks]**

QUESTION 5 [20 marks]

1. Give 2 advantages of using a glass substrate for a magnetic disk? **[2 marks]**
2. What common characteristics are shared by all RAID levels? **[3 marks]**
3. What is the difference between CAV and CLV? **[3 marks]**
4. Explain the terms striped data **[2 marks]**
5. How is redundancy achieved in a RAID system? **[2 marks]**
6. In the context of RAID, what is the distinction between parallel access and independent access? **[4 marks]**
7. The access time for retrieving a piece of data is defined as Taccess = Tseek + Trotational + Ttransfer. Given the following information calculate the access time. **[4 marks]**
   - Rotational Rate = 7200 RPM
   - Average Seek Time = 9 ms
   - Average number of sectors per track = 400

QUESTION 6 [20 marks]

1. List and explain three broad classifications of external, or peripheral, devices. **[3 marks]**
2. What is the difference between memory-mapped I/O and isolated I/O? **[4 marks]**
3. Explain the three major functions of an I/O module? **[3 marks]**
4. Below is a block diagram of an I/O module, label the lines marked A - F **[6 marks]**



7. Explain the three ways a processor can use to determine which device issued the interrupt, when a device interrupt occurs? **[3 marks]**
8. Assume a memory access to main memory on a cache "miss" takes 30 ns and a memory access to the cache on a cache "hit" takes 3 ns. If 80% of the processor's memory requests result in a cache "hit", what is the average memory access time? **[1 marks]**

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