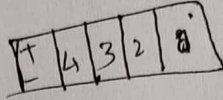


Department of Computer Science and Engineering
University of Dhaka
2nd Year, 2nd Semester, 2019
Mid Term Examination
CSE-2204: Computer Organization and Architecture

Total Mark: 30

Total Time: 1 Hours 30 Minutes

Answer All Questions



1. Why normalization is required to represent the floating point number? Consider a number format for representing the floating point number. The total number of bits is 10, where 1 bit is used to represent the sign S , 4 bits are used to represent the exponent E and remaining 5 bits are used to represent the fractional part M of the number. The significand is of form $1.M$ and 1 is a hidden bit. This number format uses excess k -bit code and k is the number of bits in E . Now determine the following:

- Bias needed to calculate the exponent.
- The number range of E .
- The most positive exponent and the most negative exponent.
- What is the normalized binary representation of the number -12.25_{10} using the above mentioned number system?

OR

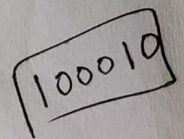
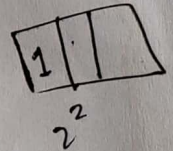
Why normalization is required to represent the floating point number? Consider a number format for representing the floating point number. The total number of bits is 20, where 1 bit is used to represent the sign S , 7 bits are used to represent the exponent E and remaining 12 bits are used to represent the fractional part M of the number. The significand is of form $1.M$ and 1 is a hidden bit. This number format uses excess k -bit code and k is the number of bits in E . Now determine the following:

- Bias needed to calculate the exponent.
- The number range of E .
- The most positive exponent and the most negative exponent.
- What is the normalized binary representation of the number 23.375_{10} using the above mentioned number system?

6

6

12 =
1100



2. Generate the machine code for the following MIPS instructions:

6

i) j 36 [Opcode=2]

ii) beq \$s1, \$s2, 100 [Opcode=4]

Let PC= 10010000 01010001 10101001 00100010. Generate the destination address for each the above-mentioned instructions.

OR

Write the MIPS instructions for $A[200] = h + A[200]$. Generate the decimal representation of each of the instruction. [Hints: Opcode for store: 43, opcode for load: 35, opcode and function for add: 0 and 32.] How does non-restoring division improve the performance of restoring division?

6

3. Describe the design of of carry lookahead adder. Draw the logic circuit of carry lookahead adder for two 3 bits numbers.

3+3=6

OR

Briefly describe a 4×5 unsigned combinational array multiplier, where multiplier $X = x_3x_2x_1x_0$ and multiplicand $Y = y_4y_3y_2y_1y_0$.

6

4. Show the steps needed to calculate $Z = X \times Y$ using Booth's multiplication algorithm, where $X = 1110_2$ and $Y = 0101_2$.

6

14 5 OR

Show the steps needed to calculate $Z = X / Y$ using non-restoring division algorithm, where $X = 1010$ and $Y = 11$.

6

5. Write the MIPS instructions for the following code segment:
for (i=0; i<3;i++)
 a[i] = a[i]+i;
where, i \rightarrow \$s3, 3 \rightarrow \$s5 and base address of a \rightarrow \$s6.

Store the following 32-bit number using both big-endian and little-endian storage method.

11101000 11001011 10011110 00011110

4+2=6

Answer all questions. Duration 30 minutes.

Problem Scenario for questions

Suppose you have to create a database to keep information about passports and immigration of Bangladesh. After processing an application, a passport is issued to a Bangladeshi national having a valid voter ID. A Bangladeshi passport contains name, father's and mother's name of a Bangladeshi national with his/her date of birth and place of birth and voter ID. Each passport has a unique ID (referred to as Passport Number) and the place of issue and date of issuing the passport is also printed on the passport. Usually, a passport is valid for 5 (five) years from the date of issue and the validity period of the same passport can be extended up to the next five years (re-issue of the passport with a new ID), through surrendering his old passport. A Bangladeshi passport-holder can apply for a new passport, before or after the expiry of his/her old passport, . In any case, a new passport is issued with a new ID.

When a passport-holder leaves Bangladesh, his passport number is entered to the immigration system at the airport and the database stores departure information. When the s/he comes back again, his/her passport number is entered to the system again and the arrival information is stored in the system.

So, the system should maintain the followings:

- a. Each passport must have a Unique Passport ID and a valid voter ID.
- b. A Bangladeshi national may have multiple passports but ONLY ONE will be valid at a particular date.
- c. All Departure and Arrival information in the database will carry a valid passport ID; i. e., the departure and arrival information should not contain any passport ID that was never issued.

The goal of the system would to store passport and immigration information for Bangladeshi nationals so that the authorities can find the following information (not limited to) instantly:

- x. List of all passport holders having a valid passport
 - y. List of all passports issued to a specific Bangladeshi national
 - z. List of passport holders that departed or arrived in a particular date or in a period between two dates.
-
1. a) Draw tabular diagram for each table that you will design for the system described above with at least two tuples in each table. 6
b) Mention which columns (or, the combination of the columns) in the tables will have unique values. 4
 2. a) Write down the SQL statements to create the tables according to your design in question number 1. 6
b) Will you use any foreign key to store the departure and arrival information? If yes, which columns will be used as foreign keys and which table and column will those refer to? 4
 3. Write both relational algebra expressions and corresponding SQL statements for the following queries:
a) List passport ID, passport holder name and voter id of all valid passports today. Use the keyword *SYSDATE* to mention 'today'. 3
b) List all passport ID, passport holder name and date of departure who have departed in between 21-FEB-2017 and 30-JUN-2017. 3
c) List the passport ID, passport holder name and passport expire date who are in Bangladesh now and their passport will expire within next 60 days. 4

Answer all questions

1. a) "Mechatronics is the synergistic integration of different subjects" Explain with example. 2
- b) Explain five elements of a Mechatronics system and their functions. 5
- c) Find the values v_1 and v_2 at node1 and node2 of Fig.1. 1.5

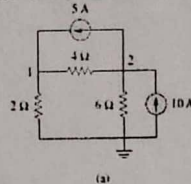


Fig.1

- d) Enlist the characteristics that make an Op Amp to ideal one. 1.5
- e) A 741 op amp has an open-loop voltage gain of 2×10^5 , input resistance of $2 \text{ M}\Omega$, and output resistance of 50Ω . The op amp is used in the circuit of Fig.2 below. Find the closed-loop gain v_o/v_s . Determine current i when $v_s = 3 \text{ V}$. 5.0

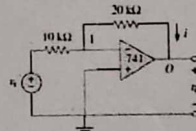


Fig.2

2. a) What do you mean by Mechanics? Explain with an example. 2.0
- b) Determine the magnitude and direction of force F_1 shown in Fig.3. 5.0

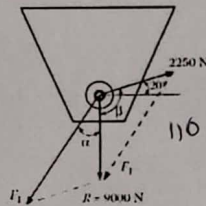


Fig.3

Or

- c) Determine the moment of inertia of a triangle with respect to its base 5.0
3. a) Differentiate between kinematics and kinetics with examples. 2.0
- b) What do you mean by Transfer Function? Explain with an appropriate equation. 3.0
- c) What do you mean by Instantaneous Center of Zero Velocity (IC). Explain with suitable diagrams how can you determine IC? 3.0
- Or
- d) Locate the IC of member BC of the three-link mechanism shown in Fig.4. Determine the angular velocity of BC if the angular velocity of BA is 2 rad/s 3.0

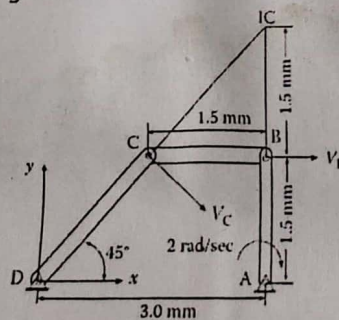


Fig.4

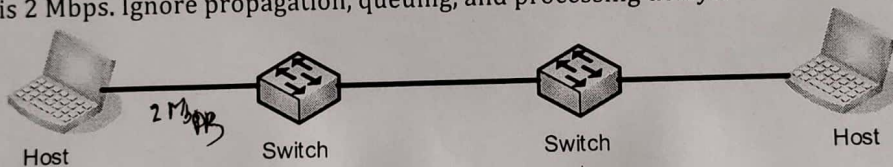
Clockwise (CW).

Dept. of Computer Science & Engineering
University of Dhaka
Mid-Term Examination 2019
Data Communications

Full Marks: 25

Time: 75 minutes

- ① With appropriate illustrations, explain why the bipolar schemes do not have DC components? 2
- 2 Define *baseband* and *broadband* transmissions. Give an examples of both transmission systems. 2
- 3 A composite signal is given by the following function $f(t) = (1 + 0.1\cos 10t)\sin 100t$. Find the amplitude, phase, and frequency of that signal and represent it in frequency domain. [$\sin x \cos x = (\sin(x+y) + \sin(x-y))/2$] 4
- 4 Distinguish between *distortion* and *noise*. 2
- ⑤ Encode the bit pattern 1010110011100111001 using NRZ-L, NRZ-I, RZ, Differential Manchester, Pseudo Ternary, and AMI schemes. 3
- ⑥ In modern packet-switched networks, including the Internet, the source host segments long, application-layer messages (for example, an image or a music file) into smaller packets and sends the packets into the network. The receiver then reassembles the packets back into the original message. Consider a message that is 8×10^6 bits long that is to be sent from source to destination in the figure below. Suppose each link in the figure is 2 Mbps. Ignore propagation, queuing, and processing delays. 2



- Now suppose that the message is segmented into 800 packets, with each packet being 10,000 bits long. Keeping in mind that each switch uses store-and-forward packet switching, how long does it take to move the first packet from source host to the first switch? When the first packet is being sent from the first switch to the second switch, the second packet is being sent from the source host to the first switch. At what time will the second packet be fully received at the first switch?
- 7 A signal with 200 milliwatts power passes through 10 devices, each with an average noise of 2 microwatts. What is the SNR? What is the SNRdB? 2
- 8 We have a channel with 3 KHz bandwidth. If we want to send data at 100 Kbps, what is the minimum SNRdB? What is the SNR? 2
- 9 Differentiate between the operations of physical layer and data link layer in the context of OSI model. 2
- ⑩ A signal generator is producing a square wave with a period of 1ms. What happens (show illustrations with possible reasons) when it is passed through: 4
- i) a lowpass filter with a cutoff frequency of 3KHz
 - ii) a highpass filter with a cutoff frequency of 3KHz
- (note the cutoff frequency of a filter is the frequency at which the signal power is attenuated by 3dB)