الجامعة السعودية الالكترونية
Saudi Electronic University

2011   1432

IT 110- Computer Organization
Assignment #1- Key

Due Date: Thursday, October 01, 2015 at 11:59 PM
Total Marks: 5

Question 1:

a) The communication component of the computer system exists to enable interconnecting systems, list its subcomponents. **[0.5 mark]**

- Hardware
    - ✓ Communication *channels*
        - Physical connections between computer systems
        - Examples: wire cable, phone lines, fiber optic cable, infrared light, radio waves
    - ✓ Interface hardware
        - Handles communication between the computer and the communication channel
        - *Modem* or *network interface card (NIC)*
- Software
    - ✓ Establish connections
    - ✓ Control flow of data
    - ✓ Directs data to the proper applications for use

b) Explain what is meant by virtualization. **[0.5 mark]**

- Virtualization is used as a broad term that refers to the abstraction of computer resource. The terms virtual and logical are used to refer to something that appears as though it is something different. Examples include:
    - ✓ Virtual memory
    - ✓ Virtual networks
    - ✓ Java Virtual Machine

Question 2:

a) Explain what is meant by the architecture of a system. **[0.5 mark]**
- The fundamental properties, and the patterns of relationships, connections, constraints, and linkages among the components and between the system and its environment are known collectively as the architecture of the system"

b) What does the top-down approach allow a system architect to do? **[0.5 mark]**

The analysis, design, and implementation of IT systems must take place at different levels of detail and frequently require collaboration among many analysts and designers. This corresponds well with the ability to decompose systems into components, hierarchically, which allows to concentrate

at the appropriate levels of detail during each step. This approach is known as a top-down approach. The top-down approach allows to focus on the specific areas of interest without the distraction of details that are irrelevant for the level that we're studying

Question 3:
a) Explain in detail about decimal and binary numbering systems with suitable examples? **[1 mark]**
Decimal Number System

1. Decimal number system has base 10 as it uses 10 digits from 0 to 9.

2. In decimal number system, the successive positions to the left of the decimal point represent units, tens, hundreds, thousands and so on.

3. Each position represents a specific power of the base (10).

For example, the decimal number 1234 consists of the digit 4 in the units position, 3 in the tens position, 2 in the hundreds position, and 1 in the thousands position, and its value can be written as

$$1234_{10} = (1 \times 10^3) + (2 \times 10^2) + (3 \times 10^1) + (4 \times 10^0)$$
$$= (1 \times 1000) + (2 \times 100) + (3 \times 10) + (4 \times 1)$$
$$= 1000 + 200 + 30 + 4$$
$$= 1234$$

Binary Number System

1. Uses two digits, 0 and 1.

2. Also called base 2 number system

Example: Binary Number: 10101_2

Calculating Decimal Equivalent:

Step	Binary Number	Decimal Number
Step 1	10101_2	$((1 \times 2^4) + (0 \times 2^3) + (1 \times 2^2) + (0 \times 2^1) + (1 \times 2^0))_{10}$
Step 2	10101_2	$(16 + 0 + 4 + 0 + 1)_{10}$
Step 3	10101_2	21_{10}

b) Convert the octal number of 12570_8 into corresponding decimal number. **[0.5 mark]**

Calculating Decimal Equivalent:

Step	Octal Number	Decimal Number
Step 1	12570_8	$((1 \times 8^4) + (2 \times 8^3) + (5 \times 8^2) + (7 \times 8^1) + (0 \times 8^0))_{10}$
Step 2	12570_8	$(4096 + 1024 + 320 + 56 + 0)_{10}$

Step 3 12570_8 5496_{10}

Question 4:

a) What data type would likely be used for a phone number and why? **[0.5 mark]**
Text (string of characters). Phone numbers are not commonly manipulated mathematically, so there is no reason to store phone numbers in numeric form. Also, phone numbers are more commonly used in text-based queries, which are more easily handled by text-based manipulation.

b) Compare ASCII and Unicode standards **[0.5 mark]**

ASCII	Unicode
Developed by ANSI (American National Standards Institute)	Allows software modifications for local-languages
Represents Latin alphabet, Arabic numerals, standard punctuation characters Plus small set of accents and other European special characters	Multilingual: defines codes for Nearly every character-based alphabet Large set of ideographs for Chinese, Japanese and Korean Composite characters for vowels and syllabic clusters required by some languages
7-bit code: 128 characters	Most common 16-bit form represents 65,536 characters

c) Compare Bitmap and Object images **[0.5 mark]**

Bitmap	Object
Used for realistic images with continuous variations in shading, color, shape and texture Represent photos and paintings	Created by drawing packages or output from spreadsheet data graphs Composed of lines and shapes in various colors Cannot represent photos or paintings
Examples: Scanned photos Clip art generated by a paint program	Example: Movies Shrek and Toy Story use object images
Preferred when image contains large amount of detail and processing requirements are fairly simple	Easy to move, scale and rotate without losing shape and identity as bitmap images may
Require big storage space	Require less storage space than bitmap images

IT 110- Computer Organization
Assignment – 2

Due Date:
Total Marks: 5

Question 1 : Points 1

a. Show how 12.25 is represented in SEEMMMMM format. (0.5)
Answer
12.25 = .1225 x 10^2
S=0
EE=52
MMMMM = 12250, where the added zero is added to make five digits
Answer: 05212250

b. How does overflow occur when using a fixed word size to represent integers? (0.5)
Answer
from the text: "A fixed word size results in a range of some particular fixed size; it is always possible to have a combination of numbers that produces a result outside the range. This condition is known as overflow."

Question 2:

a.What is meant by a Register and what does it do in a CPU? Explain briefly. (0.5)

Answer

A register is a single, permanent storage location within the CPU, which is used for a particular defined purpose. A register is used to hold a binary value temporarily for storage, for manipulation, and/or for simple calculations. Note that each register is wired within the CPU to perform its specific role. That is, unlike memory, where every address is just like every other address, each register serves a particular purpose. The register's size, the way it is wired, and even the operations that take place in the register reflect the specific function that the register performs in the computer.

b.Brief the following? (0.5, 0.5)

        2.1 Differentiate between the volatile and non-volatile memory.

        2.2 Serial versus parallel buses.

Answers-2.1:

Volatile memory: A volatile memory device holds data temporarily. It retains its data as long as it is powered by a power supply. For example, the Random Access Memory (RAM) holds its contents as

long as it is powered by a power source. However, its contents are lost when its power supply is off. Volatile memories are also called read-write memories, e.g. RAM.

Non-volatile memory: The non-volatile memory devices store data permanently, irrespective of the fact whether they are connected or not-connected to a power supply. For example, the hard drives, flash drives, floppy disks, and magnetic tape are some well-known examples of non-volatile memory.

Answers-2.1:

Parallel buses: They are comprised of the parallel electrical conductors that can carry signal simultaneously from one device to another device. They have high throughput, because all the bits of a transmission word are transmitted simultaneously. As these buses are comprised of parallel electrical conductors, therefore they are relatively expensive and require more space. Parallel buses are used for short distances (e.g., between the CPU and its peripheral devices), because they are susceptible to radio-generated electrical interference which limits their speed and length.

Serial buses: These buses basically transmit 1 bit of the transmission word at a time. Generally, they are comprised of a single data line pair and a few control lines. For many applications, throughput is higher than for parallel because of the lack of electrical interference.

. Question 3.

   a. Using the LMC program below, add comments to explain what the result (value in the calculator) is after the completion of each instruction. The first one is completed as an example. (0.5)

Mailbox	Contents	Result after completion
00	901	*Read contents from in basket and store in calculator*
01	319	....
02	901	....
03	320	....
04	219	....
05	709	....
06	518	....
07	902	....
08	000	....
09	517	....
10	902	....
11	000	....

17	DAT	
18	DAT	

| 19 | DAT |
| 20 | DAT |

Answer:

Mailbox	Contents	Result after completion
00	901	Read contents from in basket and store in calculator
01	319	Store value of calculator in mailbox 19
02	901	Read contents from in basket and store in calculator
03	320	Store value of calculator in mailbox 20
04	219	Subtract the value in calculator by value in mailbox 19
05	709	Branch to mailbox 09 if calculator is 0
06	518	Load value in mailbox 18 to calculator
07	902	Move value in calculator to out basket
08	000	Halt
09	517	Load value in mailbox 17 to calculator
10	902	Move value in calculator to out basket
11	000	Halt
-----	-----	
17	DAT	
18	DAT	
19	DAT	
20	DAT	

b. Describe the LMC three-digit instruction format. How does the LMC know what part of the value is an instruction, and what part is an address?   (0.5)

Answer: **The format of an instruction takes the form XYY**
Where X is the op code (0-9) and YY is the address (00-99).
There is no op code X=4.

The LMC only has to check the first digit for the opcode; the remaining 2 digits are an address.

IT-110 (COMPUTER ORGANIZATION)

Question 4: Points : 1.5

a. Translate the following source code into a machine code using the Assembly Language
(1)

```
1 var i = 0;
2 var j = 1;
3 var k = 0;
4 while (k < 10) {
5    var fib = i + j;
6    i = j;
7    j = fib;
```

Answer :

01	520	LDA k
02	222	SUB ten
03	717	BRZ done
04	519	LDA i
05	119	ADD j
06	321	STO fib
07	519	LDA j
08	319	STO i
09	521	LDA fib
10	319	STO j
11	519	LDA i
12	902	OUT
13	520	LDA k
14	123	ADD one
15	320	STO k
16	601	BR loop
17	000	HLT

Question 2: (0.5)

By completing the table below, translate the following source code into a machine code using the Assembly Language

```
int total = 0;
    int number = 0;
        while ( number <= 50)
{
```

```
total =total+number;
number =number+1;
}
print total;
```

Note 1: Some of the address locations have been set for you.

Answer :

Box	Code	Assembler
1	522	LDA number
2	220	SUB 51
3	711	BRZ done
4	521	LDA total
5	122	ADD number
6	321	STO total
7	522	LDA number
8	123	ADD 1
9	322	STO number
10	601	BRA loop
11	521	LDA total
12	902	OUT total
13	0	HLT

IT-110 COMPUTER ORGANIZATION

Assignment #3

Due Date: November 21st, 2015

Note: There are five questions in all. Each question carry 1 mark.

Question1: Write a code/program to evaluate the following arithmetic expression:

$$X = (A - B) * (((C - D * E) / F) / G)$$

Using a general register computer with three-address instruction.

Question2: Compare CISC and RISC with respect to their characteristics.

Question3: Discuss briefly the term "Memory interleaving".

Question4: Discuss the Step-by-Step use of Cache.

Question5: Give two advantages and two disadvantages for "Symmetrical Multiprocessing".

IT-110 COMPUTER ORGANIZATION

Solution of Assignment #3

Answer1:   SUB R1, A, B

MUL R2, D, E

SUB R2, C, R2

DIV R2, R2, F

DIV R2, R2, G

MUL X, R1, R2

Answer2:

CISC	RISC
1. Complex Instruction Set Computer.	1. Reduced Instruction Set Computer.
2. Variable length instruction format.	2. Fixed length, easily decoded instruction format.
3. A large variety of addressing modes.	3. Few addressing modes.
4. A large number of instructions.	4. Relatively few instructions.

Answer3:

Memory interleaving is a method of increasing the effective rate of memory access. This is conducted by partitioning memory into subsections, each with its own address register and data register, so that it is possible to access more than one location at a time.

Answer4:

Every CPU request to main memory is first seen by cache memory. A hardware cache controller checks the tags to determine if the memory location of the request is presently stored within the cache. If it is, the cache memory is used. If the required memory data is not present in cache memory, a cache line that includes the required location is copied from memory to the cache.

Answer5:

Advantages: (any two of the three below)

       1- High reliability
       2- Fault tolerant support is straightforward
       3- Balanced workload

Disadvantages:

    1- Resource conflicts
    2- Complex implementation

IT-110 COMPUTER ORGANIZATION

Assignment #4 solutions

1. What is a context? What does it contain? What is it used for? 1.5 point

From text "All the pertinent information about the program being suspended, including the location of the last instruction executed, and the values of data in various registers, is saved in a known part of memory, either in a special area associated with the program, known as the **process control block (PCB)**, or in a part of memory known as the stack area. This information is known as the program's **context**, and will make it possible to restart the program exactly where it left off, without loss of any data or program state."

2. Why one would disable interrupts? 0.5 point

from text "when a program is performing a critical task that would be negatively affected if an interrupt were to occur."

3. What is a software interrupt? 0.5 point
from text "an instruction that simulates an interrupt"

4. What are the issues related to superscalar processing? 1 point

Issues with superscalar processing:

- Same general categories as with pipelining: dependencies and branches
    - Dependencies (register interlock)—if an instruction needs a result from the immediately preceding instruction,
    - Branching—when the instruction being executed is a branch, we cannot know if the branch by that time, other instructions are "in flight."

- Except now forwards, stalls, or canceling may need to be between several functional units!

- CPUs become very complex again, yet it is common to have 2 to 4 separate pipelines per core in modern processors.

5. What are the three ways commonly used to improve memory performance? (Describe each one briefly) **1.5 points**

- Three ways of improving memory performance:

    - Wide path memory access—increase bandwidth to memory by fetching multiple bytes at a time.

    - Memory interleaving—increase bandwidth to memory by fetching in parallel across blocks.

    - Cache memory—decrease latency to memory by having fast copies closer to the CPU. Must keep memory synchronized with cache.

IT 110- Computer Organization
Assignment – 5
Due Date: Dec 12th, 2015
Total Marks: 5

Q1: Write a short note on any four categories of network security? (0.5 pts)
    Answer:
1. Intrusion: Keeping network and system resources free from intruders
2. Confidentiality: Keeping the content of data private
3. Authentication: Verifying the identity of a source of data being received
4. Data integrity and non-repudiation: Protecting the content of data communication against changes and verifying the source of the message
5. Assuring network availability and access control: Keep network resources operational and restricting access to those permitted to use them

Q2: Among the two methods DHCP is the one to distribute IP addresses more efficiently. Explain it in brief how distribution is done by DHCP? (0.5 pts)

Answer: It maintains a bank of available IP addresses and assign them dynamically to computers for use when the computers are attached to the network and often used by large organizations, DSL and cable providers. In general DHCP client on computer or network device broadcasts a query to locate the DHCP server and DHCP server responds with a lease which includes an IP address, domain name of network, IP address of DNS server, subnet mask, IP address of gateway and other configuration parameters

Q3: What are the advantages of switched Ethernet over hub- or bus-based Ethernet? (1 pts)
Switched Ethernet is based logically on a star topology. Each node of the network is connected to a central switch that is capable of connecting any two nodes together. When a node on the network wishes to communicate with another node, the switch sets up a direct connection between the two. Standard Ethernet cables contain at least two pairs of wires, which are used to make the connections full-duplex. Multiple pairs of nodes can communicate at full bandwidth through the switch simultaneously. For wired local area networks, switched Ethernet is the prevalent method in use today.
Because every device connected to the hub is sharing the bandwidth of the network, the bandwidth available to individual connections decreases at least proportionally to the number of units using the network. When traffic is heavy, there may be many devices contending for use of the bus. A medium access control protocol called CSMA/CD (Carrier Sense Multiple Access with Collision Detection) is used to manage access to the bus, but, traffic jams can occur, and the performance of hub-based Ethernet deteriorates rapidly when traffic is heavy.

Q4: Explain the major differences between TCP and UDP (1pts)

|		
Acronym for	Transmission Control Protocol	User Datagram Protocol or Universal Datagram Protocol
Connection	TCP is a connection-oriented protocol.	UDP is a connectionless protocol.
Function	As a message makes its way across the internet from one computer to another. This is connection based.	UDP is also a protocol used in message transport or transfer. This is not connection based which means that one program can send a load of packets to another and that would be the end of the relationship.
Usage	TCP is suited for applications that require high reliability, and transmission time is relatively less critical.	UDP is suitable for applications that need fast, efficient transmission, such as games. UDP's stateless nature is also useful for servers that answer small queries from huge numbers of clients.
Use by other protocols	HTTP, HTTPs, FTP, SMTP, Telnet	DNS, DHCP, TFTP, SNMP, RIP, VOIP.
Ordering of data packets	TCP rearranges data packets in the order specified.	UDP has no inherent order as all packets are independent of each other. If ordering is required, it has to be managed by the application layer.
Speed of transfer	The speed for TCP is slower than UDP.	UDP is faster because there is no error-checking for packets.
Reliability	There is absolute guarantee that the data transferred remains intact and arrives in the same order in which it was sent.	There is no guarantee that the messages or packets sent would reach at all.
Header Size	TCP header size is 20 bytes	UDP Header size is 8 bytes.
Common Header Fields	Source port, Destination port, Check Sum	Source port, Destination port, Check Sum
Streaming of data	Data is read as a byte stream, no distinguishing indications are transmitted to signal message (segment) boundaries.	Packets are sent individually and are checked for integrity only if they arrive. Packets have definite boundaries, which are honored upon receipt, meaning a read operation at the receiver socket will yield an entire message as it was originally sent.
Weight	TCP is heavy-weight. TCP requires three packets to set up a socket connection, before any user data can be sent. TCP handles reliability and congestion control.	UDP is lightweight. There is no ordering of messages, no tracking connections, etc. It is a small transport layer designed on top of IP.
Data Flow Control	TCP does Flow Control. TCP requires three packets to set up a socket connection, before any user data can be sent. TCP handles reliability and congestion control.	UDP does not have an option for flow control
Error Checking Fields	TCP does error checking 1. Sequence Number, 2. AcK number, 3. Data offset, 4. Reserved, 5. Control bit, 6. Window, 7. Urgent Pointer 8. Options, 9. Padding, 10. Check Sum, 11. Source port, 12. Destination port	UDP does error checking, but no recovery options. 1. Length, 2. Source port, 3. Destination port, 4. Check Sum
Acknowledgement	Acknowledgement segments	No Acknowledgment
Handshake	SYN, SYN-ACK, ACK	No handshake (connectionless protocol)
Checksum	Checksum	to detect errors

Q5:

a) Who owns Internet backbones? (0.5 pts)

International service providers how have built high-speed fiber optic Internet backbones that carry traffic between large cities throughout the world.

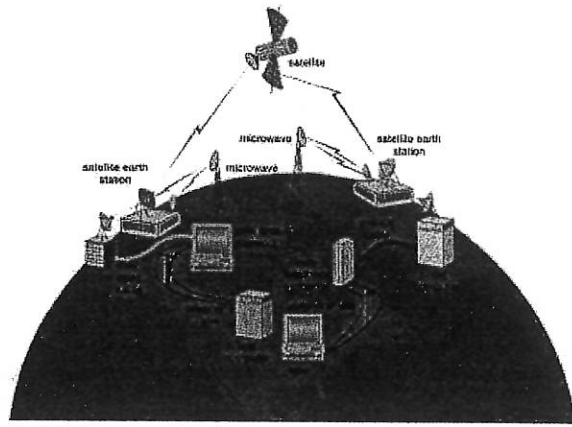### b) What is the major difference in implementation between a LAN and a MAN or WAN? (1pts)

LAN
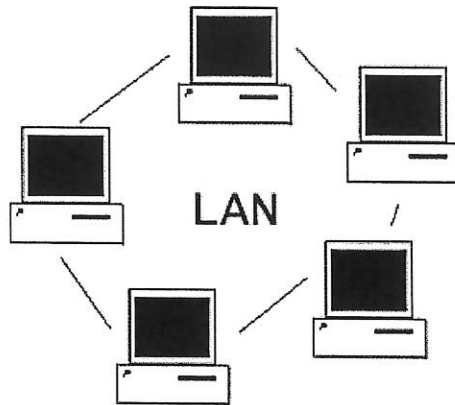
1 LAN (Local Area Network) is a group of computers and other network devices which are connected together.
2 All the devices that are part of LAN are within a building or multiple building.
3 LAN network has very high speed mainly due to proximity of computer and network devices.
4 LAN connection speeds can be 10Mbps or 100Mbps or 1000Mpbs also.
5 LAN uses Guided Media

MAN
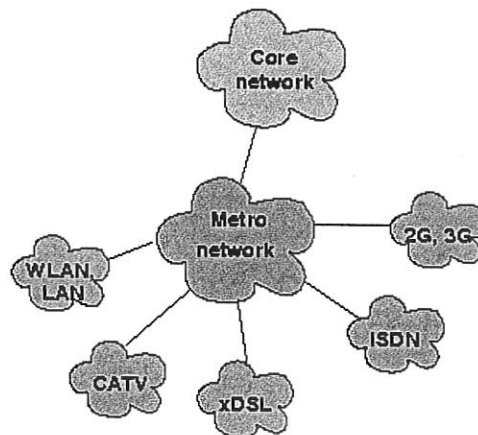
1 MAN ((Metropolitan Area Network) is a larger network of computers and other network devices which are connected together usually spans several buildings or large geographical area.
2 All the devices that are part of MAN are span across buildings or small town.
3 MAN network has lower speed compared to LAN.
4 MAN connection speeds can be 10Mbps or 100Mbps.
5 MAN uses Guided Media or Unguided media.

WAN

6 WAN (Wide Area Network) is a group of computers and other network devices, which are connected together, which is not restricted to a geographical location. Internet is WAN

7 All the devices that are part of WAN have no geographical boundaries.

8 WAN speed varies based on geographical location of the servers. WAN connects several LANs

9 WAN connection speeds can be 10Mbps or 100Mbps.

10 WAN mainly uses Guided Media or Unguided media. Its long distance communications, which may or may not be provided by public packet network.

c) What is the major advantage of layering in the network model? (0.5 pts)

Separating the tasks involved in communication adds flexibility, simplifies design of the protocols, makes it possible to modify protocols or substitute alternative protocols without affecting unrelated tasks, and allows a system to select only the protocols that it needs for a particular application.

or

A layered model, such as the TCP/IP model, is often used to help visualize the interaction between various protocols. A layered model depicts the operation of the protocols occurring within each layer, as well as the interaction of protocols with the layers above and below each layer. There are benefits to using a layered model to describe network protocols and operations. Using a layered model: Assists in protocol design, because protocols that operate at a specific layer have defined information that they act upon and a defined interface to the layers above and below. Fosters competition because products from different vendors can work together. Prevents technology or capability changes in one layer from affecting other layers above and below. Provides a common language to describe networking functions and capabilities.

Saudi Electronic University
الجامعةالسعودية الالكترونية
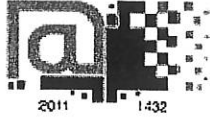
Mid-Term Examination Cover Sheet
First Semester: 1436-1437 / 2015-2016

Course Instructor:		Exam Date:	29/10/2015
Course Title:	Computer Organization	Course Code:	IT-110
Exam Duration:	1 hour	Number of Pages:(including cover page)	

Exam Guidelines

- Mobile phones are not permitted.
- Calculators are permitted.
- Calculator sharing is NOT allowed.

Marking Scheme

Questions	Score
Q1	/10
Q2	/8
Q3	/10
Q4	/12
Q5	/10
Exam Score/50	/50
Mid-Term Score/25	/25

Student Name:	Student ID:

الجامعة السعودية الالكترونية
Saudi Electronic University

Ministry of Higher Education
Saudi Electronic University
College of Computing and Informatics

PART I- Multiple Choice Questions   10 Marks
[10 Questions – Each question carry 1 mark]

1. The main memory, often known as primary storage, working storage, or RAM (for random access memory), holds

  a) Data
  b) Program instructions
  c) Program instructions and data·
  d) Program instructions, data and instructions for booting the computer

2. The architecture of the computer system rests on a solid foundation that has changed only slightly and gradually since the

  a) Late 1930s
  b) Late 1940s
  c) Late 1950s
  d) Late 1960s

3. System decomposition means
  a) Compatibility
  b) Irreducible
  c) May be subsystems
  d) The division of a system into its components and linkages

4. Find the answer for 3_8 x 6_8 = _____
  a) 18_8
  b) 22_8
  c) 9_8
  d) 24_8

5. What is the base of Hexadecimal?
  a) 10
  b) 2
  c) 8
  d) 16

6. Image files that store each individual point within the image are
  a) Glyphs
  b) Vector images
  c) Object images
  d) Bitmap images

7. An 8-bit storage location can store any unsigned integer of value between 0 and
   a) 7
   b) 16
   c) 255
   d) 512

8. How do you find the 2's complement of positive numbers?
   a) Invert the numbers
   b) Invert the numbers and add one
   c) Invert the numbers and wrap around the leftmost bit
   d) Do nothing the complement is the same as the original

9. Which sequence of commands is needed to output two numbers from the mailbox of LMC (using the OUTPUT command)?
   a) LOAD, OUTPUT, STORE, OUTPUT
   b) LOAD, OUTPUT, LOAD, OUTPUT
   c) LOAD, OUTPUT, OUTPUT, LOAD
   d) OUTPUT, STORE, LOAD, OUTPUT

10. Compiler translates high-level language to
    a) Machine language
    b) Human readable
    c) Assembly
    d) None

PART-II TRUE/FALSE QUESTIONS   8 Marks
[8 Questions – Each question carry 1 mark]

1. The components of an individual computer system consist of processing hardware, input Devices, output devices, storage devices, application software and operating system Software. [TRUE]

2. Client-server is less efficient and less cost-effective than Peer-to-peer. [FALSE]

3. Shifting a number in any base *left* one digit *multiplies* its value by the base. [TRUE]

4. Analog data is continuous data such as sound or images. [TRUE]

5. The leftmost bit in an IEEE standard floating point number represents the sign of the Mantissa. [TRUE]

6. The BRANCH ON ZERO instruction "jumps" if the value in the calculator is zero by changing the value in the program counter (also called instruction location counter). [TRUE]

7. A program written in assembly language is called virtual. [FALSE]

8. An assembly language program is translated into its corresponding machine language program by assembler. [TRUE]

PART III -Fill in the Blanks   10 Marks
[10 Questions – Each question carry 1 mark]

1) Images, numbers and characters are represented in computer as ....
Answer: Binary number

2) The range of a 1 byte number stored in BCD format is .... to ....
Answer: 0-99

3) Using sign-and-magnitude representation, if the leftmost bit is 1 the number is ....
Answer: Negative

4) In LMC, The program is written in machine code and is stored in the ....
Answer: Mailbox

5) In LMC, Each memory slot has an address between 00 and 99. Each memory slot can contain one 3-digit .... or data.
Answer: Instruction

6) MP3 is an .... Standard.
Answer: Audio

7) Hexadecimal numbers use the Base 16, and the symbols from ... to ... and ... to ....
Answer: 0 to 9 and A to F.

8) The data entered from a keyboard as characters, number digits and punctuation are known as .... data.
Answer: Alphanumeric

9) There are many different data compression algorithms but all fall into one of the two categories, lossless or ....
Answer: Lossy

10) Number of bytes that is needed to store an ASCII character is .... byte.
Answer: One

PART-IV Short Answer Questions   12 Marks
[3 Questions – Each question carry 4 marks]

1) What data type would likely be used for a phone number and why?
Answer: (string of characters). Phone numbers are not commonly manipulated mathematically, so there is no reason to store phone numbers in numeric form. Also, phone numbers are more commonly used in text-based queries, which are more easily handled by text-based manipulation.

2) Find the 2's complementary representation in 8-bits of the number -51.

Answer: Step 1: 51 in binary using 8-bits is 00110011
              Step 2: Flip the bits: 11001100
              Step 3: add 1: 11001101

3) Briefly explain the four generations of programming languages?

الجامعة السعودية الالكترونية
Saudi Electronic University

Answer:

Generation 1: Programmed directly in binary using wires or switches

Generation 2: Assembly language was introduced in this generation, human readable, converted directly to machine code

Generation 3: High level languages, while loops, if-then-else, structured. Most programming today including object oriented languages

Generation 4: in this generation natural languages, non-procedural , report generation was introduced and used programs to generate other programs.

PART-V Long Answer Question   10 Marks
[2 Questions – Each question carry 5 marks]

---

1) Calculate largest positive integer that can be stored in 2 bytes using

    a) An unsigned integer

    b) An integer using sign and magnitude

Answer: This is useful: The relationship between largest positive integer and the number (n) of bits used is largest positive number using n bits = 2^n-1

a) Largest positive integer = $2^{16} - 1$

= 65536 − 1

= 65,535

b) In two bytes there are 16 bits, of those 15 are available for positive numbers:

= $2^{15} - 1$

= 32768 − 1

= 32,767

2) Consider the following Little Man program which shows the mailbox address (Memory Location); the Opcode; and the Mnemonic for the Opcode. Complete the following table to depict the process of reading in and then adding a sequence of three numbers A, B & C. The variables take on the values: A = 10, B = 20 & C = 30.

Instruction			Mailbox		
Address	**Opcode**	**Mnemonics**	**98**	**99**	**Calculator**
00	901	IN (A)			
01	398	STA 98			
02	901	IN (B)			
03	399	STA 99			
04	901	IN (C)			
05	198	ADD 98			
06	199	ADD 99			
07	902	OUT			
08	000	COB			

Answer:

Instruction			Mailbox		
Address	Opcode	Mnemonics	98	99	Calculator
00	901	IN (A)	unknown	unknown	10
01	398	STA 98	10	unknown	10
02	901	IN (B)	10	unknown	20
03	399	STA 99	10	20	20
04	901	IN (C)	10	20	30
05	198	ADD 98	10	20	40
06	199	ADD 99	10	20	60
07	902	OUT	10	20	60
08	000	COB			

*****END*****