1.

	Max Dec	Min Dec	Max Hex	Min Hex
2's Compliment	$2^{31} - 1$	-2^{31}	7FFFFFFF	-80000000
Unsigned	$2^{32} - 1$	0	FFFFFFFF	0

Range of 2's compliment in the decimal form is -2^{N-1} to 2^{N-1} - 1 , where N is number of bits.
Range of unsigned in decimal form is 0 to 2^N - 1

2.

Bit length for binary and hex representations-->	16-bits	8-bits	16-bits	16-bits
Decimal	369	-37	403	-15383
Binary	0000 0001 0111 0001	1101 1011	0000 0001 1001 0011	1100 0011 1110 1001
Octal	561	333	623	141751
Hex	171	DB	193	C3E9

For 369:

369 in binary form would be 0000 0001 0111 0001 (we get the binary form by dividing the number by 2 until the number becomes zero, the remainders will be the binary number)

369 in octal form will be 561 (We get the octal form by dividing the number by 8 until the number becomes zero, the remainders at each step will be the octal number)

369 in Hex form will be 171 (We get the Hex form by dividing the number by 16 ubtil the number becomes zero, the remainders at each stage will be the hex number.)

For 1101 1011 :

For binary number with n digits:
dn-1 … d3 d2 d1 d0
The decimal number is equal to the sum of binary digits (dn) times their power of 2 (2n):
decimal = $d0 \times 2^{\wedge}0 + d1 \times 2^{\wedge}1 + d2 \times 2^{\wedge}2 + ...$

Converting the binary to its 2's compliment we will get   0010 0101 = - 37

To convert binary to octal we need to segment the binary into a pair of three and convert the three bits to decimal.
For 1101 1011 we get 333

For binary to hexadecimal we need to segment the binary into a pair of four and convert the four bits to decimal.
For 1101 1011 we get DB

For 623:

For octal to decimal conversion
$623 = (6 \times 8^2) + (2 \times 8^1) + (3 \times 8^0) = 403$

For octal to binary conversion:
Convert each octal digit to 3 binary digits 623
6 2 3
= 110 010 011
= 110010011

For Octal to hexadecimal conversion
Convert every octal digit to 3 binary digits, then convert every 4 binary digits to1 hex digit.
623
= 6 2 3
= 110 010 011
= 1 1001 0011

For C3E9 :

Hexadecimal to decimal
$(C3E9)_{16} = (12 \times 16^3) + (3 \times 16^2) + (14 \times 16^1) + (9 \times 16^0) = (50153)_{10}$
In the signed 2's compliment form it will be -15383

Hex to binary:
Convert each hex digit to 4 binary digits
c 3 e 9
= 1100 0011 1110 1001
= 1100001111101001

Hex to Octal:
Convert each hex digit to 4 binary digits and then convert each 3 binary digits to octal digits
c3e9
= c 3 e 9
= 1100 0011 1110 1001
= 1 100 001 111 101 001
= 1 4 1 7 5 1
= 141751

3.

  Packed BCD: 927   => 0X927 =>   0 x 0927   =>   0000 1001 0010 0111

For packed BCD we combine two numbers to be represented using 8bits.

  Unpacked BCD: 927   =>   0 x 090207   =>   0000 1001 0000 0010 0000 0111

For unpacked BCD we use 8bits to represent 1 number.

Dec to Hex: 927   =>   39F
Hex to ASCII :   39F   =>   9
As professor explained in class we can represent 39F in ASCII as 0x333946 or 0x33 0x39 0x46

4.

    MAR stands for Memory Address Register
    MBR stands for Memory Buffer Register
    IBR   stands for   Instruction Buffer Register

There are four main structural components of a computer. They are
1. **CPU (Central processing unit):**
It is the main part of the computer. It controls the operations of the computer and performs its data processing functions. It is the heart of the computer. It is usually named by the processor.

2. **Main memory:**
This part of the computer is used for the storage of data.
3. **I/O devices:**
These devices are used for sending and receiving the data from computer to its external environment. These are referred as the channel between the computer system and the external world. And also the other peripheral communication lines.
4. **System Interconnection:**
Lines that connect several components to enable them to perform their specific operations or some mechanism that is used for the communication between CPU, main memory and the I/O devices.

A Processor is a physical piece of silicon containing one or more cores. It is the computer component that interprets and executes instructions. If it has multiple cores its called a multi-core system. For a single core it is equivalent to a CPU and the CPU has four main components.
The four components of the CPU are:
A: **Control Unit**: this is the main part of the CPU; it is the part in the CPU which controls the operation of the CPU and hence the computer. It is responsible for all the processing.
B: **ALU**: it is the acronym of Arithmetic Logic Unit, this part of the CPU performs all the necessary arithmetic functions. Performs the computer data processing function.
C: **Registers**: This is a small unit in the CPU for the storage of small amount of data.
D: **CPU interconnection**: This is mechanism which is used for the communication between registers, ALU and Control Unit.

A Processor consists of Cache at multiple levels as well. Cache is a small amount of memory which is fast to access than the main memory.

5.

Moore's Law refers to Gordon Moore's perception that the number of transistors on a microchip doubles every two years, though the cost of computers is halved. Moore's Law states that we can expect the speed and capability of our computers to increase every couple of years, and we will pay less for them. Another tenet of Moore's Law asserts that this growth is exponential.

The consequences of Moore's Law is as follows.
1. The cost of computer logic and memory circuitry has fallen at a dramatic rate.
2. The electrical path length is shortened, increasing operating speed.
3. Computers become smaller and is more convenient to use in a variety of environment.
4. Reduction in power and cooling requirements.
5. Fewer interchip connections.

6.

Computer	Embedded device
A computer is a combination of hardware and software resources which integrate together and provides various functionalities to the user.	An embedded device is a part of an integrated system that An embedded is formed as an combination of computer hardware and software for a specific function and which can operate without human interaction.
A computer needs Human Interaction to perform tasks.	Embedded device does not need Human Interaction to perform tasks.
It has 2 parts: Hardware and Software.	It has 3 parts: Hardware, Firmware and Software.
It can perform many tasks.	It performs limited tasks.
The user has to pay more for a computer.	The user incurs lesser cost for an embedded system.
Computers have peripherals such as keyboard and mouse, display, printer, Hard disk drives, floppy disk drives, optical disc drives etc.	Embedded Devices have peripherals such as Serial Communication Interfaces (SCI), Synchronous Serial Communication Interface, Universal Serial Bus (USB), Multi Media Cards (SD cards, Compact Flash) etc.

Computer	Embedded device
Computers can be reprogrammed to for a new purpose.	Embedded Devices are made only for a specific set of purposes.
Computer needs more operational power than Embedded Devices.	Embedded Device needs lesser operational power than a Computer.
Computers are more complex devices than Embedded Devices.	Embedded Devices are less complex devices than Computers.

7.

Advantages of using family based architecture are.

1. Every model has similar or identical instruction set and OS, which makes it easy to upgrade with less effort.
2. Models are compatible in the sense that a program written for one model should be capable of being executed by another model in the series.
3. A customer can have a relatively inexpensive model with modest requirements and budget.