**Level 1: Presentation Notes**

1. Number systems used in Computer Science
   1. List the main features of the Decimal System  
      used for communicating with human user

Digits: 0,1,2,3,4,5,6,7,8,9  
  
List the main features of the Decimal System

* 1. List the main features of the Binary System  
       
     used by internal CPU and memory circuits

Digits: 0,1 (ON or OFF)

* 1. List the main features of the Octal System  
     used by computer scientist for grouping of 3 binary digits   
     no digits 8 & 9

* 1. List the main features of the Hexadecimal System  
     used by computer scientist for grouping of 4 binary digits

it also uses extra letter

1. Compare and contrast the Decimal and Binary systems

|  |  |  |
| --- | --- | --- |
| **Criteria** | **Decimal System** | **Binary System** |
| Digits  Used | 0,1,2,3,4,5,6,7,8,9 | Use digits 0,1 (true or false) (+ or -) |
| Addition Example | 0+1=1  1+1=2  9+1=10 | 0+1=1  1+1=10  11+1=100 |
| Powers of  Base | 10^0=1  10^1=10  10^2=100 | 2^0=1 (or 2 decimals)  2^1=10 (or 4 decimals)  2^2=100 |
| Value of 111 | 111=10^2+10^1+10^0  (100+10+1) | 111= 2^2 + 2^1 + 2^0  (Decimal: 4+2+1 =7) |

1. Convert the following binary numbers to decimal:
2. Convert the following decimal numbers to binary:
3. Add the following binary numbers. (verify your answers using decimal)

|  |  |
| --- | --- |
| a) | b) |
| c) | d) |

1. List the main features of the following Computer Memory Structures:
   1. Bit
   2. Byte
   3. Word
   4. Integer Data Type
   5. Double Word

**Level 2: Research Questions**

1. The Intel 8085 microprocessor was a first generation processor that was used in many early game systems and personal computers. Google “8085 microprocessor architecture” to answer these questions.
   1. Year Introduced

It was made in the year 1976

* 1. Size of data bus (in bits)

8

* 1. Largest data number (in binary and decimal)

The largest data number is11111111 is binary and decimal is 2^8-1 decimal

* 1. Size of address bus (in bits)

16

* 1. Largest memory address (in binary and decimal)

The largest number in binary is 1111 1111 1111 1111 and in decimal 2^16-1=65535

1. The Intel 8086 microprocessor was the processor used in the first IBM PCs running the DOS operating system. Google “8086 microprocessor architecture” to answer these questions.
   1. Year Introduced

1976

* 1. Size of data bus (in bits)

16 bits data bus

* 1. Largest data number (in decimal)

The largest number in binary is 1111 1111 1111 1111 and in decimal is 2^16-1=65535

* 1. Size of address bus (in bits)

20 bits

* 1. Largest memory address (in decimal)

The largest number in binary is 1111 1111 1111 1111 1111 and in decimal 2^20-1=1048575

1. The Intel 80286 microprocessor a common processor used in IBM PCs running the Windows operating system. Google “80286 microprocessor architecture” to answer these questions.
   1. Year Introduced

1982

* 1. Size of data bus (in bits)

16 bits

* 1. Largest data number (in decimal)
  2. Size of address bus (in bits)

24 bits

* 1. Largest memory address (in decimal)

The largest address memory is 1111 1111 1111 1111 1111and in decimal is 2^20-1=1048575

1. The modern PCs run either a 32 bit or 64 bit Windows operating system. Google “32 vs 64 bit” to answer these questions.
   1. How do these systems differ in data capacity? (explain using bits)

64-bit is more capable than 32-bit processor because it can handle more data at once

* 1. How do these systems differ in memory capacity? (explain using bits)

 64-bit processor is capable of storing more computational values, including memory addresses it means that about 4 billion times of 32-bit processor

* 1. How do these systems differ in hardware requirements?

64 bit processor aren’t capable of running 16 bits program because they are older and sometimes aren’t capable of running older 32 bit programs

1. Research and explain how negative (-) numbers are represented using bits and how they are stored in computer memory.  
   “An integer is a number with no fractional part; it can be **positive**, negative or zero.

In ordinary usage, one uses a minus sign to designate a negative integer”.

1. Research and explain how floating point (decimal) numbers are represented using bits and how they are stored in computer memory.

“The exponent is **stored** as an unsigned integer, for 32-bits **floating**-**point values**, this field is 8 bits. The rest of the binary digits are **stored** in an integer field, in the 32-bit case this field is 23 bits”

**Level 3: Sample Program**

1. Modify the following sample Python program to print out the digits in:
   1. Binary
   2. Octal
   3. Hexadecimal

number = input("Enter a 4 digit decimal number:")

index = 0

for char in number :

index += 1

print("Digit ", index, " is : ", hex(int(char)))

number = input("Enter a 4 digit decimal number:")

index = 0

for char in number :

index += 1

print("Digit ", index, " is : ", char)