**Level 1: Presentation Notes**

1. Number systems used in Computer Science
   1. List the main features of the Decimal System

* 1. List the main features of the Binary System

* 1. List the main features of the Octal System

* 1. List the main features of the Hexadecimal System

1. Compare and contrast the Decimal and Binary systems

|  |  |  |
| --- | --- | --- |
| **Criteria** | **Decimal System** | **Binary System** |
| Digits  Used |  |  |
| Addition Example |  |  |
| Powers of  Base |  |  |
| Value of 111 |  |  |

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 introduced in 1967
  1. Size of data bus (in bits)
* It has an 8 bit data bus
  1. Largest data number (in binary and decimal)
* The largest data number in binary is 1111 1111 and in decimal is 28-1=255
  1. Size of address bus (in bits)
* It has a 16 bit address bus with
  1. Largest memory address (in binary and decimal)
* The largest address number is 1111 1111 1111 1111 in binary and 216-1=65535 in decimal

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

* It was introduced in 1976
  1. Size of data bus (in bits)
* It has a 16 bit data bus
  1. Largest data number (in decimal)
* The largest data number in binary is 1111 1111 1111 1111 and in decimalis 216-1=65535 in decimal
  1. Size of address bus (in bits)
* It has a 20 bit address bus
  1. Largest memory address (in decimal)

The largest address memory in binary is 1111 1111 1111 1111 1111 and in decimal is220-1=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

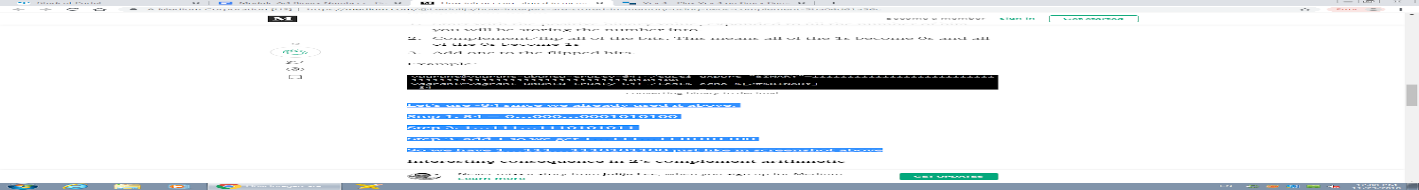
* It was introduced in 1982
  1. Size of data bus (in bits)
* It has a 16 bit data bus
  1. Largest data number (in decimal)
* The largest data number in binary is 1111 1111 1111 1111 and in decimalis 216-1=65535 in decimal
  1. Size of address bus (in bits)
* It has a 24 bit address bus
  1. Largest memory address (in decimal)

The largest address memory in binary is 1111 1111 1111 1111 1111 1111 and in decimal is 224-1=16777215

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)

* 32 bit processors are capable of handling 4GB while 64 bit processors are capable of handling more than 4GB
* the 32 bit data capacity is 232-1=4,294,967,295 in decimal and 32 bits
* the 64 bit data capacity is 262-1= 18,446,744,073,709, 551,615 and 64 bits
  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
* the 32 bit data capacity is 232-1=4,294,967,295 in decimal and 32 bits
* the 64 bit data capacity is 262-1= 18,446,744,073,709, 551,615 and 64 bits
  1. How do these systems differ in hardware requirements?
* 64 bit processors aren’t capable of running 16 bit programs because they are older and sometimes aren’t capable of running older 32 bit programs
* 32 bit processor can’t install a 64 bit operating system, but it can install a 32 bit operating system

1. Research and explain how negative (-) numbers are represented using bits and how they are stored in computer memory.

* there are compiler differentiates between positive and negative number from a bit
* MSB (most significant bit) is used in the process of this
* if there’s a 0 the number is positive although if there’s a 1 the number is negative
* to convert a negative number into a number that matches 2’s complement form you first need to start with a positive binary value expanded to fit the bits in the system
* then you flip the bits which means all the 1’s become 0’s and all the 0’s become 1’s
* after that you add one
* an example:

Let’s use 84 bits

Step 1. 84 = 0…000…0001010100

Step 2. 1…111…1110101011

Step 3. add 1 so we get 1…111…1110101100

So we have 1…111…1110101100 just like in screenshot above

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

**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 : ", char)