**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 by Intel in the year 1976.

* 1. Size of data bus (in bits)

8085 microprocessor is an 8-bit microprocessor.

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

In binary, the largest data number would be 0 to 1111 1111. In decimal, the largest number would be 0 to 28 – 1= 255

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* 1. Size of address bus (in bits)

The size of address is 16 bits.

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

1111 1111 1111 1111 in binary and 65536 Bytes 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 the year 1978.

* 1. Size of data bus (in bits)

The size of data bus is 16 bits.

* 1. Largest data number (in decimal)

The largest data number in decimal is 216 which is 65536.

* 1. Size of address bus (in bits)

The size of address bus is 20 bits.

* 1. Largest memory address (in decimal)

1048575 in decimal.

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

Introduced in 1982.

* 1. Size of data bus (in bits)

The size of data bus is 16 bits.

* 1. Largest data number (in decimal)

65536 in decimal.

* 1. Size of address bus (in bits)

The size of address bus is 24 bits.

* 1. Largest memory address (in decimal)

The largest memory address in decimal is 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 has a data capacity of 232 – 1 = 4.2949673×109 whereas 64 bit has a data capacity of 264 – 1 = 1.84467441×1019

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

32 bit can store 32 bits of memory whereas 64 bit can store around 4 billion times that amount.

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

64 bit runs more easily compared to a 32 bit because it has more memory space making it easy to access files. In 64 bit, more data can be processed at once as compared to 32 bit.

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

They are stored based on signed magnitude, one’s magnitude, or two’s magnitude. Whichever section the negative number comes under, it will be stored under it. They are stored in an integer field.

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

One bit has the sign, and some bits form the factor as a fixed-precision number(“mantissa”), and the remaining bits form the exponent. Now the exponent will have a base of 2.

**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)

Shown to Mr. Nester.