**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)

**8-bit data bus.**

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

**In Binary (0 – 1111 1111)**

**In Decimal (0 -255)**

* 1. Size of address bus (in bits)

**16-bit address bus.**

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

**In Binary (0 – 1111 1111 1111 1111)**

**In Decimal (0 -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

**It was introduced by Intel in the year 1976.**

* 1. Size of data bus (in bits)

**16-bit data bus**

* 1. Largest data number (in decimal)

**In Decimal (0 -255)**

* 1. Size of address bus (in bits)

**20 -bit address bus.**

* 1. Largest memory address (in decimal)

**In Decimal (0 -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 by Intel in the year 1982.**

* 1. Size of data bus (in bits)

**16-bit data bus**

* 1. Largest data number (in decimal)

**In Binary (0 – 1111 1111 1111 1111)**

**In Decimal (0 -255)**

* 1. Size of address bus (in bits)

**24 -bit address bus**

* 1. Largest memory address (in decimal)

**In Decimal (0 -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 Windows- 2 to the power of** **32-bit**

**64 bit Windows- 2 to the power of** **64-bit**

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

**32 bit Windows- maximum of 4 gigabytes**

**64 bit Windows- maximum of 17,179,869,184 gigabytes**

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

**32 bit Windows- CPU needs to be able to store 32bit extensions**

**64 bit Windows- CPU needs to be able to store 64bit extensions**

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

**Whenever a number with negative sign is seen, the number ignores the negative sign, that is then converted to its binary number. Then the two numbers are calculated. That two number is located in the memory and the sign bit is set to 1 because the binary number being kept is a negative number.**

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

**The floating point numbers are separated into a sign, mantissa, and exponent bits when it is in a binary format.**

**Turning a floating point number into a decimal involves the following steps:**

* **Separately process the decimal and binary parts of the number and convert them into binary format**
* **Normalize the binary number by moving the decimal point to the leftmost position**
* **Convert the exponent part into binary**

**Level 3: Sample Program**

1. Modify the following sample Python program to print out the digits in:
   1. Binary

|  |  |
| --- | --- |
| White area | Black area |
| number = input("Enter a 4 digit decimal number:")  index = 0  for char in number :  index += 1  print("Digit ", index, " is : ",bin(int(char))) | Enter a 4 digit decimal number:1334  Digit 1 is : 0b1  Digit 2 is : 0b11  Digit 3 is : 0b11  Digit 4 is : 0b100 |

* 1. Octal

|  |  |
| --- | --- |
| White area | Black area |
| number = input("Enter a 4 digit decimal number:")  index = 0  for char in number :  index += 1  print("Digit ", index, " is : ",oct(int(char))) | Enter a 4 digit decimal number:1334  Digit 1 is : 0o1  Digit 2 is : 0o3  Digit 3 is : 0o3  Digit 4 is : 0o4 |

* 1. Hexadecimal

|  |  |
| --- | --- |
| White area | Black area |
| number = input("Enter a 4 digit decimal number:")  index = 0  for char in number :  index += 1  print("Digit ", index, " is : ",hex(int(char))) | Enter a 4 digit decimal number:1334  Digit 1 is : 0x1  Digit 2 is : 0x3  Digit 3 is : 0x3  Digit 4 is : 0x4 |

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

index = 0

for char in number :

index += 1

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