**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 1976
  1. Size of data bus (in bits)
* 8 bits
  1. Largest data number (in binary and decimal)
* Decimal: 255
* Binary: 11111111
  1. Size of address bus (in bits)
* 16 bits
  1. Largest memory address (in binary and decimal)
* Decimal: 65535
* Binary: 1111111111111111

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 1978
  1. Size of data bus (in bits)
* 16 bits
  1. Largest data number (in decimal)
* Decimal: 65535
  1. Size of address bus (in bits)
* 20 bits
  1. Largest memory address (in decimal)
* Decimal: 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)
* 16 bits
  1. Largest data number (in decimal)
* Decimal: 65535
  1. Size of address bus (in bits)
* 24 bits
  1. Largest memory address (in decimal)
* Decimal: 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)

A 32 bit computer has 4294967296 bits whereas a 64 bit computer has 18446744073709551615 bits.

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

A 32 bit system can only utilise 4 GB of RAM whereas 64 bit systems can utilise over 2000 PB of RAM.

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

A 64 bit system requires a special type of processor and can utilize more RAM than a 32 bit system.

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

The leftmost digit of a binary number represents if the number is positive or negative.

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

Decimal Numbers are first normalized using special math equations and then stored in computer memory in Binary. This equation follows a scientific notation that is used to compress every decimal number to 32 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 = int(input("Enter a 4 digit decimal number:"))

def convert(x, base):

z = ""

while(x > 0):

r = x%base

z = str(r if r < 10 else chr(r+55)) + z

x = x//base

return z

print(convert(number, 2))

print(convert(number, 8))

print(convert(number, 16))