Question 2:

a)

Loop:

Category	Instructions	CPI(Clock Cycle per Instruction)	Instruction Count
A: Arithmetic and Comparison	add, addu, sub, slt, etc..	1	42
B: Memory	lw, sw	8	2
D: Branch and Jump	beq, bnq, j, jal	2	13

Recursion:

Category	Instructions	CPI(Clock Cycle per Instruction)	Instruction Count
A: Arithmetic and Comparison	add, addu, sub, slt, etc..	1	103
B: Memory	lw, sw	8	77
D: Branch and Jump	beq, bnq, j, jal	2	75

b)

Loop:

Clock cycles = Instruction Count x Cycles Per Instruction

Clock cycles = (1 x 42) + (8 x 2) + (2 x 13)

= 42 + 16 + 26

= 84

Recursion:

Clock cycles = Instruction Count x Cycles Per Instruction

Clock cycles = (1 x 103) + (8 x 77) + (2 x 75)

= 103 + 616 + 150

= 869

c)

Loop:

Clock cycles = Instruction Count x Cycles Per Instruction

Clock cycles = (1 x 42) + (4 x 2) + (2 x 13)
= 42 + 8 + 26
= 76

Increase in function speed = (Old Total Clock Cycle – New Total Clock Cycle) / Old Total Clock Cycle

Increase in function speed = (84 - 76) / 84 = 0,095238 ≈ %10

Recursion:

Clock cycles = Instruction Count x Cycles Per Instruction

Clock cycles = (1 x 103) + (4 x 77) + (2 x 75)
= 103 + 308 + 150
= 561

Increase in function speed = (Old Total Clock Cycle – New Total Clock Cycle) / Old Total Clock Cycle

Increase in function speed = (869 - 561) / 869 = 0,354430 ≈ %36

Computer Organization Midterm/Homework **Mehmet Kadri Gofralılar**

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Question 3:

a)

Minimum Integer Value = -2147483648_{10}

2's Complement: $10000000000000000000000000000000_2$

Hexadecimal: 80000000_{16}

Maximum Integer Value = 2147483647_{10}

2's Complement: $00000000000000000000000000000001_2$

Hexadecimal: $7FFFFFFF_{16}$

b)

$-22.2_{10}=-(16+4+2+0,2)_{10}=-10110.0011001100110011001_2 = -1.01100011001100110011001_2 \times 2^4$

$X=-1.01100011001100110011001_2 \times 2^4$ ➔ $X = (-1)^S \times (1 + \text{Fraction}) \times 2^{(\text{Exponent - Bias})}$

S=1 since number is negative

Fraction = $01100011001100110011001_2$

S	Exponent	Fraction

Exponent - Bias = Exponent – 127 = 4 => Exponent = $131_{10} = 10000011_2$

Therefore 32 bit floating point representation of 22.2_{10} is:

1 10000011 01100011001100110011001