CENG 2032 Spring 2021 Final Homework

2)

A.

Category	Instructions	CPI(Clock Cycle per Instruction)	Instruction Count
A: Addition, subtraction and comparison	add, addu, sub, slt, etc..	1	79
B: Memory	lw, sw, l.s, s.s, l.d, s.d	4	46
C: Branch and Jump	beq, bnq, j, bc1t, bc1f, etc	2	23
D: Floating point Arithmetic and Comparison	add.s, sub.s, add.d, sub.d, c.XX.s, c.XX.d etc	2	34

B.

Total Clock Cycles = 1 x 79 + 4 x 46 + 2 x 23 + 2 x 34

= 377

Average Clock Cycle per Instruction = 377 / (79 + 46 + 23 + 34)

= 2,071 ≈ 2,07

3)

A.

Base CPI = 4

Data Miss Rate = %20

Miss Penalty = 100 CC

Load/store = (46/182) ≈ 0,25

Actual CPI (for Memory) = Base CPI + I-cache + D-cache

= 4 + 0 x 4 + 0,25 x 0,2 x 100

= 9

Total Clock Cycles = 1 x 79 + 9 x 46 + 2 x 23 + 2 x 34

= 607

Average Clock Cycle per Instruction = 607 / (79 + 46 + 23 + 34)

= 3,335 ≈ 3,34

B.

Base CPI = 4

Access Time = 20 CC

Global Miss Rate to Main Memory = %5

Data Miss Rate = %20

Miss Penalty = 100 CC

Total CPI = Base CPI + primary stalls per instruction + secondary stalls per instruction

= 4 + 0,2 x 20 + 0,05 x 100

= 13

Total Clock Cycles = 1 x 79 + 13 x 46 + 2 x 23 + 2 x 34

= 791

Average Clock Cycle per Instruction = 791/ (79 + 46 + 23 + 34)

= 4,346 ≈ 4,35

4)

$-111,1110 = -(64+32+8+4+2+1+0,11)_{10} = -\ 1101111,00011100001010001_2$

$= -\ 1,10111100011100001010001_2 \times 2^6$

$X = -\ 1,10111100011100001010001_2 \times 2^6$ ➔ **$X = (-1)S \times (1 + \text{Fraction}) \times 2^{(\text{Exponent - Bias})}$**

S	Exponent	Fraction

S=1 since number is negative, **Fraction =** $10111100011100001010001_2$,

Exponent - Bias = Exponent – 127 = 6 => **Exponent =** $133_{10} = 10000101_2$

Therefore 32 bit floating point representation of -111,1110 is:

1 10000101 10111100011100001010001

5)

speedup = old time / new time <= 1/((1-P)+(P/N)) => max speedup = 1/((1-P)+(P/N))

max speedup = 25

processors = N = 100

percentage of the original computation can be sequential = (1-P) =?

25 = 1 / ((1-P) + (P/100)) => P = 96/99 ≈ 0,97 => (1-P) = 0,03