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FACULTY OF ENGINEERING & TECHNOLOGY

CSPS-106 Computer Organization

Lecture-03

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OUTLINE

- FLOATING POINT NUMBERS
- BINARY EQUIVALENCE
- FRACTIONAL PART – MULTIPLICATION METHOD
- FRACTIONAL PART – SUBTRACTION METHOD
- BINARY EQUIVALENT OF FP NUMBER

FLOATING POINT NUMBERS

- Now you've seen **unsigned** and **signed** integers. In real life we also need to be able represent numbers with fractional parts (like: -12.5 & 45.39).
  - Called **Floating Point** numbers.
  - You will learn the IEEE 32-bit floating point representation.

In the decimal system, a decimal point (**radix point**) separates the whole numbers from the fractional part

Examples:

37.25 (whole = 37, fraction = 25/100)

123.567

10.12345678

FLOATING POINT NUMBERS

For example, 37.25 can be analyzed as:

10^1	10^0		10^{-1}		10^{-2}
Tens	Units		Tenths	Hundredths	
3		**7**	**2**		**5**

37.25 = (3 x 10) + (7 x 1) + (2 x 1/10) + (5 x 1/100)

BINARY EQUIVALENCE

The binary equivalent of a floating point number can be determined by computing the binary representation for each part separately.

1) For the **whole** part:

Use subtraction or division method previously learned.

2) For the **fractional** part:

Use the subtraction or multiplication method (to be shown next)

FRACTIONAL PART – MULTIPLICATION METHOD

In the binary representation of a floating point number the column values will be as follows:

… 2^5	2^4	2^3	2^2	2^1	2^0 .	2^{-1}	2^{-2}	2^{-3}	2^{-4} …
… 32	16	8	4	2	1 .	1/2	1/4	1/8	1/16…
… 32	16	8	4	2	1 .	.5	.25	.125	.0625…

FRACTIONAL PART – MULTIPLICATION METHOD

Ex 1. Find the binary equivalent of **0.25**

Step 1: Multiply the fraction by 2 until the fractional part becomes 0

.25

x 2
0.5
x 2
1.0

Step 2: Collect the whole parts in forward order. Put them after the radix point

. .5 .25 .125 .0625
. 0 1

FRACTIONAL PART – MULTIPLICATION METHOD

Ex 2. Find the binary equivalent of **0.625**

Step 1: Multiply the fraction by 2 until the fractional part becomes 0

.625

x 2
1.25
x 2
0.50
x 2
1.0

Step 2: Collect the whole parts in forward order. Put them after the radix point

. .5 .25 .125 .0625
. 1 0 1

FRACTIONAL PART – SUBTRACTION METHOD

Start with the column values again, as follows:

… 2^0 .	2^{-1}	2^{-2}	2^{-3}	2^{-4}	2^{-5}	2^{-6}…
… 1 .	1/2	1/4	1/8	1/16	1/32	1/64…
… 1 .	.5	.25	.125	.0625	.03125	.015625…

FRACTIONAL PART – SUBTRACTION METHOD

Starting with 0.5, subtract the column values from left to right. Insert a 0 in the column if the value cannot be subtracted or 1 if it can be. Continue until the fraction becomes .0

Ex 1.

.25	**.5**	**.25**	**.125**	**.0625**
- .25	**.0**	**1**		
.0				

BINARY EQUIVALENT OF FP NUMBER

Ex 2. Convert 37.25, using subtraction method.

64	32	16	8	4	2	1	.	.5	.25	.125	.0625
2^6	2^5	2^4	2^3	2^2	2^1	2^0	.	2^{-1}	2^{-2}	2^{-3}	2^{-4}

1 0 0 1 0 1 . 0 1

37	.25
- 32	- .25
5	.0
- 4	
1	
-1	
0	

$37.25_{10} = 100101.01_2$

Ex 3. Convert 18.625, using subtraction method.

64	32	16	8	4	2	1	.	.5	.25	.125	.0625
2^6	2^5	2^4	2^3	2^2	2^1	2^0	.	2^{-1}	2^{-2}	2^{-3}	2^{-4}
		1	0	0	1	0		1	0	1	

18	.625
- 16	- .5
2	.125
- 2	- .125
0	0

$$18.625_{10} = 10010.101_2$$

Multiple Choice Question

MUTIPLE CHOICE QUESTIONS:

Sr no	Question	Option A	Option B	OptionC	OptionD
1	Which registers can interact with the secondary storage?	MAR	PC	IQ	IR
2	During the execution of a program which gets initialized first?	MAR	PC	IR	IQ
3	Which of the register/s of the processor is/are connected to Memory Bus?	PC	IR	MAR	IQ
4	ISP stands for _____	Instruction Set Processor	Interchange Standard Protocol	Information Standard Processing	Interrupt Service Procedure
5	The internal components of the processor are connected by _____	Processor intra-connectivity circuitry	Processor Bus	memory bus	ram bus

REFERENCES

- http://www.engppt.com/search/label/Computer%20Organization%20and%20Architecture
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