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Experiment / assignment / tutorial No.10

TITLE: Study of basic computer organisation and architecture concepts through Virtual lab

AIM: Understanding Virtual Lab concepts

Expected OUTCOME of Experiment:

Books/ Journals/ Websites referred:

https://cse11-iiith.vlabs.ac.in/exp/floating-point-numbers/

Pre Lab/ Prior Concepts:

The main aim of this experiment is to provide remote-access to Labs in various disciplines of Science and Engineering. These Virtual Labs would cater to students at the undergraduate level, post graduate level as well as to research scholars. Also, to enthuse students to conduct experiments by arousing their curiosity. This would help them in learning basic and advanced concepts through remote experimentation. It also provides a complete Learning Management System around the Virtual Labs where the students can avail the various tools for learning, including additional web-resources, video-lectures, animated demonstrations and self-evaluation. We can share costly equipment and resources, which are otherwise available to limited number of users due to constraints on time and geographical distances **Salient Features:**

. 1. Virtual Labs will provide to the students the result of an experiment by one of the following methods (or possibly a combination)

- Modeling the physical phenomenon by a set of equations and carrying out simulations to yield the result of the particular experiment. This can, at-the-best, provide an approximate version of the 'real-world' experiment.
- Providing measured data for virtual lab experiments corresponding to the data previously obtained by measurements on an actual system.
- Remotely triggering an experiment in an actual lab and providing the student the result of the experiment through the computer interface. This would entail carrying out the actual lab experiment remotely.

2. Virtual Labs will be made more effective and realistic by providing additional inputs to the students like accompanying audio and video streaming of an actual lab experiment and equipment.

Observations:

Title of Study Experiment: Floating Point Numbers Representation

Brief description of experiment under study:

This experiment explores the concept of floating point representation, which is a method used by computers to store and handle real numbers. It demonstrates how real numbers, including very large or very small values, can be approximated in binary form within limited memory. The experiment helps understand the limitations and precision errors that arise when representing real numbers in floating point format.

PRETEST:

Floating Point Numbers Representation

1. Consider the decimal number 15.75. How can we convert this entire number (both the integer and fractional parts) to binary?
- a: Repeated multiplication to convert the fractional part (0.75).
- b: Repeated division to convert the integer part (15)
- c: Repeated division to convert the integer part (15), Repeated multiplication to convert the fractional part (0.75) and then combine both parts.
- d: None of the aobve

2. In 32 bit IEEE Format Floating Point the Sign bit equals
- a: 1 when the number is negative and is 0 when the number is positive.
- b: 0 when the number is negative and is 1 when the number is positive.
- c: 0 when the number is negative and is 0 when the number is positive.
- d: All of the above

Submit Quiz

2 out of 2

OUTPUT:

Floating Point Numbers Representation

DECIMAL NUMBER: 12.345
BITS FOR EXPONENT: 8
Submit Reset

RESULTS

8-bit binary: 010000010
Binary Representation Of Integeral Part: 1100
Binary Representation Of Fractional Part: 01011000
Binary Representation of the Number: 1100.01011000
Normalised Representation of the Number: 1. X 2 power3
Sign: 0
Bias: 127
Mantiss:
Expone: 130

DECIMAL NUMBER: -23.14
BITS FOR EXPONENT: 11
Submit Reset

RESULTS

8-bit binary: 110000000011
Binary Representation Of Integeral Part: 10111
Binary Representation Of Fractional Part: 00100011
Binary Representation of the Number: 10111.00100011
Normalised Representation of the Number: 1. X 2 power4
Sign: 1
Bias: 1023
Mantiss:
Expone: 1027

DECIMAL NUMBER

0.2314

BITS FOR EXPONENT

11

Submit Reset

RESULTS

8-bit binary

001111111100

Binary Representation Of Integeral Part

0

Binary Representation Of Fractional Part

00111011

Binary Representation of the Number

0.00111011

Normalised Representation of the Number

1. X 2 power-3

Sign

0

Bias

1023

Mantiss

Expone

1020

SIMULATION2

Simulations

Floating Number 2.3

Submit Reset

Normalised De-Normalised

Exponent	Manitissa	No zero	Abrupt	Denorm
00	00	0.500	0	0
00	01	0.625	0	0.250
00	10	0.750	0	0.500
00	11	0.875	0	0.750
01	00	1.000	1.000	1.000
01	01	1.250	1.250	1.250
01	10	1.500	1.500	1.500
01	11	1.750	1.750	1.750
10	00	2.000	2.000	2.000
10	01	2.500	2.500	2.500
10	10	3.000	3.000	3.000
10	11	3.500	3.500	3.500
11	00	Infinity	Infinity	Infinity
11	01	Nan	Nan	Nan
11	10	Nan	Nan	Nan
11	11	Nan	Nan	Nan

Simulations

Floating Number 8.6

Submit Reset

Normalised De-Normalised

Exponent	Manitissa	No zero	Abrupt	Denorm
00	00	0.500	0	0
00	01	0.625	0	0.250
00	10	0.750	0	0.500
00	11	0.875	0	0.750
01	00	1.000	1.000	1.000
01	01	1.250	1.250	1.250
01	10	1.500	1.500	1.500
01	11	1.750	1.750	1.750
10	00	2.000	2.000	2.000
10	01	2.500	2.500	2.500
10	10	3.000	3.000	3.000
10	11	3.500	3.500	3.500
11	00	Infinity	Infinity	Infinity
11	01	Nan	Nan	Nan
11	10	Nan	Nan	Nan
11	11	Nan	Nan	Nan

POSTTEST:

1. Can zero be represented using normalized representation?
- a: Yes
- (●) b: No
- c: Sometimes
- d: Information is not sufficient

2. Which of the following is true for floating number 0.3?
- (●) a: Only 5-bit binary Normalised representation is possible
- b: 5-bit binary Denormalised representation is possible
- c: It's Exponent is oo, Mantissa is oo and Denorm is o
- d: Both b and c

Submit Quiz

2 out of 2

Post Lab Descriptive Questions

1. What are the applications of the virtual lab case study / tool reviewed by you?

The applications of the IIITH virtual lab are as follows

- Learning floating point representation based on IEEE 754 standards
- Practicing decimal-to-floating-point conversions
- Exploring precision limits and rounding errors

- Simulating arithmetic operations with floating point numbers
- Preparing for advanced computer architecture and numerical methods

Conclusion:

The virtual lab effectively demonstrates floating point representation, enabling understanding of IEEE 754 standards, precision limitations, and rounding errors. It enhances learning through simulations and remote access, preparing students for advanced concepts in computer architecture and numerical computations.

Date: 12/09/2025