Brac University
Department of Computer Science and Engineering
Summer 2025

Name: **10 Marks**
Student ID: **25 Minutes**
Section:

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1. If $\beta = 2$, fraction is of 3 bits exponent is of 2 bits, What will be the non-negative lowest and highest number that can be generated using the Normalized form of floating point representation? N.B: Exponent range starts from 1.

exponent is of 2 bits, so for exponent $2^2 = 4$ possible values exist.
non-negative lowest = 0.1000×2^1
highest : 0.1111×2^4

2. Derive the formula for machine epsilon (ϵ_M) for the Normalized form of floating point representation.

Same as lecture notes

3. For a system if $\beta = 2$, m=3 and e ϵ {-4,3} in a system following Normalized form how many non-negative number can be represented?

Normalized form = $\pm 0.1 d_1 d_2 d_3 \times 2^e$

$\therefore$ Total non-negative values = $2^3 \times 8 = 64$

4. If x=31/16, find fl(x) where e ϵ {-3,3}, m=3 and the system follows Denormalized Form of floating point representation. Also find the relative rounding error.

$x = \frac{31}{16} = \frac{16}{16} + \frac{8}{16} + \frac{4}{16} + \frac{2}{16} + \frac{1}{16} = 2^0 + 2^{-1} + 2^{-2} + 2^{-3} + 2^{-4}$

$= 1.1111 \times 2^0$

1.1111×2^0

1.111×2^0 | 1.000×2^1

$= (2^0 + 2^{-1} + 2^{-2} + 2^{-3}) \times 2^0$ | $= 2^0 \times 2^1$

$= 1.875$ | $= 2$

avg = 1.9375 = 1.1111

Since it is at the middle it will round to 1.000×2^1

$\therefore$ error = $\frac{|1.9375 - 2|}{1.9375} = 0.3226$