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COURSE TITLE : APPLICATION OF INFORMATION AND COMMUNICATION TECHNOLOGY
(CSC- 107)

1. How to Convert Binary:

- To Decimal: Add up powers of 2 for both the whole number and the fractional part.
- To Octal: Group the binary digits into sets of three and convert.
- To Hexadecimal: Group the binary digits into sets of four and convert.

2. Hexadecimal and Floating-Point Representation:

Some fractions in binary don't have a neat equivalent in decimal, they often turn into repeating decimals.

Advantages and disadvantages:

- Hexadecimal is used because it's compact, easier to read, and aligns perfectly with how computers store data (in chunks like 8, 16, or 32 bits).
- However, it can be less precise than binary and harder to understand for beginners.

3. Impact of Byte Size on Range:

1. Ranges Expand:
- With 2 bytes: you can count from 0 to 65,535 if unsigned, or from -32,768 to 32,767 if signed.
- With 4 bytes: the range jumps to over 4 billion for unsigned numbers or about -2.1 billion to 2.1 billion for signed.

Larger byte sizes mean less chance of overflow where the number exceeds the limit and "wraps around" to start over, causing errors in calculations.

4. Programming Language Behavior:

- C and C++: They don't check for overflow by default, so things can go wrong quietly. Some compilers and tools can help catch it.
- Java: Offers methods to catch overflow and throw an error.
- Python: Automatically switches to bigger numbers, so overflow isn't an issue.
- Extra Tools: Tools like AddressSanitizer can flag overflow problems during testing.

Floating-Point Numbers and the Hidden Bit:

- Floating-point numbers assume the first digit is always 1, the "hidden bit" to save space.
- This helps represent larger and smaller numbers more efficiently. For tiny values, if they can't use the hidden bit, they "softly degrade" to avoid sudden errors.

5. Exceptions in IEEE Arithmetic

- Dividing by Zero: Produces infinity.
- Overflow: Numbers too big become infinity.
- Underflow: Numbers too small are rounded to zero or a very tiny value.
- Invalid Math: Things like 0/0 or sqrt{-1} result in "Not a Number" (NaN).