

ESE

MADE EASY
WORKBOOK 2025



**Detailed Explanations of
Try Yourself *Questions***

ELECTRICAL ENGINEERING
Computer Fundamentals



1

Data Representation



Detailed Explanation of Try Yourself Questions

T1 : Solution

0	0 1 1 1 1 1 1 1	000 0000 0000 0000 0000 0000
1 bit	8 bit	23 bit

1. Sign = 0 (positive)

2. BE = 01111111

$$\text{Bias} = +(2^{8-1} - 1)$$

$$= +127$$

∴ Actual exponent = BE-bias

i.e.

$$\begin{array}{r} 01111111 \\ 01111111 \\ \hline 00000000 = 0 \end{array}$$

3. Mantissa = 0000...23 bits (0's)

$$= 0$$

∴ Normalized mantissa = 1 M

$$= 1.0$$

$$\text{Actual number} = +1.0 * 2^0$$

$$= +1$$



2

Basic CPU Architecture



Detailed Explanation of Try Yourself Questions

T1 : Solution

(d)

In the horizontal programming control signals are expressed in a decoded binary format. So all the (a), (b) and (c) options are correct.

T2 : Solution

(b)

Average instruction execution time = $\Sigma(IC_i \times CPI_i)$ cycle time

$$\Rightarrow (0.3 \times 8) + (0.2 \times 4) + (0.3 \times 12) + (0.2 \times 12)$$

$$\Rightarrow (2.4 + 0.8 + 3.6 + 2.4)$$

$$\Rightarrow 9.2 \text{ cycles}$$

So, execution time = $9.2 \times \frac{1}{2.3} \text{ ns} = 4 \text{ ns}$

$$1 \text{ Instruction} \begin{array}{l} \diagdown \\ \diagup \end{array} 4 \text{ ns}$$

$$\# \text{ Instruction} \begin{array}{l} \diagup \\ \diagdown \end{array} 1 \text{ ns}$$

$$\Rightarrow 250 \text{ MIPS}$$

T3 : Solution

(b)

$$\text{Maximum bits required} = 20 + 70 + 2 + 10 + 23$$

$$\text{When the groups are horizontal} = 125$$

$$\text{Minimum bits required} = \log_2 20 + \log_2 70 + \log_2 2 + \log_2 10 + \log_2 23$$

$$\text{When the groups are vertical} = 5 + 7 + 1 + 4 + 5 = 22$$

$$\# \text{ bits save} = (125 - 22) = 103$$

T4 : Solution

(c)

In the instruction fetch process, CPU reads the instruction from the memory based on a program counter.



3

Memory Organization



Detailed Explanation of Try Yourself Questions

T1 : Solution

(a)

$$\begin{aligned}\# \text{ chips required} &= \frac{\text{Needed}}{\text{given}} \\ &= \frac{256 \text{ kB}}{32\text{k} \times 1} \\ &= \frac{2^8 \times 2^{10} \times 2^3}{2^5 \times 2^{10} \times 2^0} = \frac{2^{21}}{2^{15}} = 2^6 = 64\end{aligned}$$

T2 : Solution

(c)

$$\begin{aligned}\# \text{ chips required} &= \frac{2 \text{ M} \times 32}{512 \text{ K} \times 8} \\ &= \frac{2^1 \times 2^{20} \times 2^5}{2^9 \times 2^{10} \times 2^3} \\ &= \frac{2^{26}}{2^{22}} = 2^4 = 16\end{aligned}$$

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4

Input-Output Organization



Detailed Explanation of Try Yourself Questions

T1 : Solution

(c)

Interrupt occurs during the execution of a current instruction. So, CPU will be respond to a interrupt after 12 cycles.

T2 : Solution

(d)

Temperature sensor is a critical component in the CPU design. So it is a non-maskable interrupt.
∴ High priority is associated.

T3 : Solution

(b)

Vectored interrupt contain the interrupt vector so, vector address is calculated based on this vector.

T4 : Solution

(a)

DMA steals the control of a data bus and address bus to transfer the data from IO to main memory.

