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MADE EASY Workbook 2024

Detailed Explanations of Try Yourself *Questions*

ELECTRICAL ENGINEERING

Computer Fundamentals

MADE EASY Publications

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

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

   = +127

$\therefore$ Actual exponent = BE-bias

i.e.

$$\begin{array}{r} 0\,1\,1\,1\,1\,1\,1\,1 \\ 0\,1\,1\,1\,1\,1\,1\,1 \\ \hline 0\,0\,0\,0\,0\,0\,0\,0 = 0 \end{array}$$

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

   = 0

$\therefore$ Normalized mantissa = 1 M

= 1.0

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

= +1

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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 cycles

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

1 Instruction — 4 ns

Instruction — 1 ns

$\Rightarrow$ 250 MIPS

T3 : Solution

(b)

Maximum bits required = 20 + 70 + 2 + 10 + 23

When the groups are horizontal = 125

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

When the groups are vertical = 5 + 7 + 1 + 4 + 5 = 22

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.

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3 Memory Organization

Detailed Explanation of Try Yourself Questions

T1 : Solution

(a)

$$\#\text{ chips required} = \frac{\text{Needed}}{\text{given}}$$

$$= \frac{256\,\text{kB}}{32\text{k} \times 1}$$

$$= \frac{2^8 \times 2^{10} \times 2^3}{2^5 \times 2^{10} \times 2^0} = \frac{2^{21}}{2^{15}} = 2^6 = 64$$

T2 : Solution

(c)

$$\#\text{ chips required} = \frac{2\,\text{M} \times 32}{512\,\text{K} \times 8}$$

$$= \frac{2^1 \times 2^{20} \times 2^5}{2^9 \times 2^{10} \times 2^3}$$

$$= \frac{2^{26}}{2^{22}} = 2^4 = 16$$

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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.

$\therefore$ 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.

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