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Computer Organization and Architecture

Problem solving of previous NET papers

ABOUT ME : MURALIKRISHNA BUKKASAMUDRAM

- M.Tech with 20 years of Experience in Teaching GATE and Engineering colleges
- IIT NPTEL Course topper in Theory of computation with 96 %
- IGIP Certified (Certification on International Engineering educator)
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- Trained more than 50 Thousand students across the country
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Problem solving of previous NET papers

1 The Boolean expression $\overline{A}.B+A.\overline{B}+A.B$ is equivalent to

A. $\overline{A}.B$

B. $\overline{A+B}$

C. A.B

D. A + B

$\bar{A}B + A\bar{B} + AB$

$\bar{A}B + A\underline{(\bar{B}+B)}$

$\underline{\bar{A}B + A}$.

$(\bar{A}+A)(B+A)$

$1.(B+A)$

$(A+B)$ ✓

Problem solving of previous NET papers

2 A computer uses a memory unit with 256 K words of 32 bits each. A binary instruction code is stored in one word of memory. The instruction has four parts : an indirect bit, an operation code and a register code part to specify one of 64 registers and an address part. How many bits are there in the operation code, the register code part and the address part?

A. 7, 6, 18
B. 6, 7, 18
C. 7, 7, 18
D. 18, 7, 7

256K words
32 bits
2^{18}

64 Registers
Address Part

$\log_2 64$

$256K \times 32$

$2^{18} \times 32$

32 bits

I	Opcode	Reg.Code	Address
1	7	6	18

$\boxed{7, 6, 18}$

I = 0 (Direct)

I = 1 (Indirect)

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3 Consider the following x86 – assembly language instructions:

MOV AL, 153 0110 0110 CF = 0 SF = 0

NEG AL

AL = 1001 1001

The contents of the destination register AL (in 8-bit binary notation), the status of Carry Flag (CF) and Sign Flag (SF) after the execution of above instructions, are

A. AL = 0110 0110; CF = 0; SF = 0

B. AL = 0110 0111; CF = 0; SF = 1

C. AL = 0110 0110; CF = 1; SF = 1

D. AL = 0110 0111; CF = 1; SF = 0

$\boxed{CF = 1}$

153

128
16
8
2 1
153

$\boxed{10011001}$

1001 1001

0110 0110
1

0110 0111

0110 0111

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$(40.1)_{10}$

$(101000.00011\,0011\,0011\ldots)$

4 The decimal floating point number -40.1 represented using IEEE-754 32-bit representation and written in hexadecimal form is

A. 0xC2206666
B. 0xC2206000
C. 0xC2006666
D. 0xC2006000

$-(1.01000\,00011\,0011\,0011\ldots) \times 2^5$

EXP − 127 = 5, EXP = 132

EXP :- 10000100

S : 1

F : 01000000110011001100110 11 - - -

1 10000100 01000000011001100110 0110

C 2 2 0 6 6 6 6

0.1 × 2
0.2 × 2
0.4 × 2
0.8 × 2
1.6 × 2
1.2 × 2
0.4 × 2
0.8 × 2
1.6 × 2
1.2 × 2
0.4

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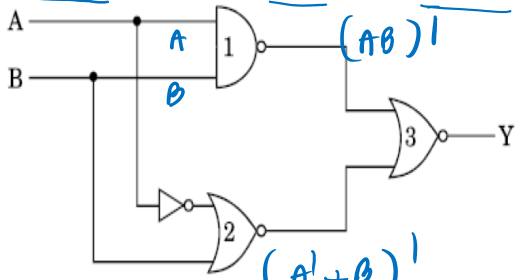
6 Find the Boolean expression for the logic circuit shown below:
(1-NAND gate, 2-NOR gate, 3-NOR gate)



$((AB)' + (A'+B)')'$

$(AB)(A'+B)$

$ABA' + ABB = 0 + AB$

A. $A\bar{B}$

B. $\bar{A}B$

C. AB

D. $\bar{A}\,\bar{B}$

2^n sectors

n-bits

7. Consider a disk pack with 32 surfaces, 64 tracks and 512 sectors per pack. 256 bytes of data are stored in a bit serial manner in a sector. The number of bits required to specify a particular sector in the disk is

A. 18
B. 19
C. 20
D. 22

Sol :- $32 \times 64 \times 512 \times 256$ Bytes

$2^5 \times 2^6 \times 2^9 \times 2^8 = 2^{28}$

$2^5 \times 2^6 \times 2^9$ sectors $= 2^{20}$ Sectors

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8\. Consider a system with 2 level cache. Access times of Level 1 cache, Level 2 cache and main memory are 0.5 ns, 5 ns and 100 ns respectively. The hit rates of Level 1 and Level 2 caches are 0.7 and 0.8, respectively. What is the average access time of the system ignoring the search time within the cache?

A. 35.20 ns

B. 7.55 ns

C. 20.75 ns

D. 24.35 ns

$$\text{Avg} = 0.7 \times [0.5] + 0.3 \times [0.8 \times [5 + 0.5] + 0.2 \times [100 + 5 + 0.5]]$$

$$= 0.7 \times 0.5 + 0.3 \times [0.8 \times 5.5 + 0.2[105.5]]$$

$$= 0.35 + 0.3[4.40 + 21.10]$$

$$= 0.35 + 7.65$$

$$= 8$$

$5.5 \times 8 = 4.40$

$105.5 \times 2 = 211.0$

$4.40 + 21.10 = 25.50$, $25.50 \times 0.3 = 7.650$

$7.65 + 0.35 = 8.00$

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9\. A non-pipelined system takes 30ns to process a task. The same task can be processed in a four-segment pipeline with a clock cycle of 10ns. Determine the speed up of the pipeline for 100 tasks.

A. 3

B. 4

C. 3.91

D. 2.91

	10	10	10	10		
T_1	S_1	S_2	S_3	S_4		
T_2		S_1	S_2	S_3	S_4	
T_3			S_1	S_2	S_3	-

$$\text{Speed up} = \frac{\text{Time taken for Non-pipeline}}{\text{Time-taken for pipeline}}$$

NP = $30 \times 100 = 3000$ ns

$4 \times 10 + 99 \times 10$

$40 + 990$

1030 ns

$$\text{Speed up} = \frac{3000}{1030}$$

=

Problem solving of previous NET papers

512 K words

2^{19} words

256 Register

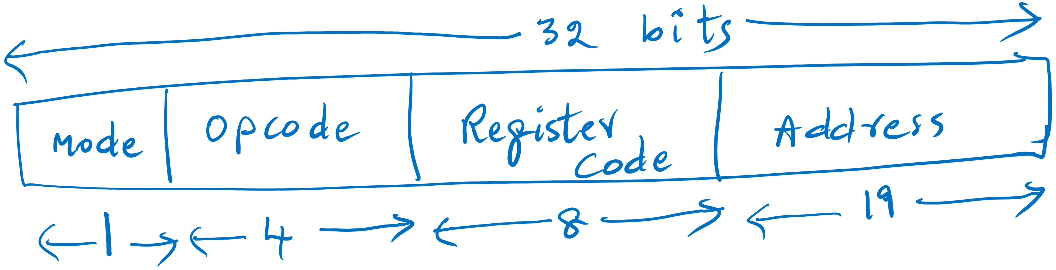
10 A computer uses a memory unit of 512 K words of 32 bits each. A binary instruction code is stored in one word of the memory. The instruction has four parts: an addressing mode field to specify one of the two-addressing mode (direct and indirect), an operation code, a register code part to specify one of the 256 registers and an address part. How many bits are there in addressing mode part, opcode part, register code part and the address part?

A. 1,3,9,19

B. 1,4,9,18

C. 1,4,8,19

D. 1,3,8,20



1, 4, 8, 19

11. A micro instruction format has microoperation field which is divided into 2 subfields F1 and F2, each having 15 distinct microoperations, condition field CD for four status bits, branch field BR having four options used in conjunction with address field AD. The address space is of 128 memory words. The size of micro instruction is:

A. 19
B. 18
C. 17
D. 20

128 words
7 bits
15

F1	F2	CD	BR	AD
4	4	2	2	7

00
01
10
11

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12

12 1. Given following equation:

$(142)_b + (112)_{b-2} = (75)_8$, find base b.

A. 3

B. 6

C. 7

D. 5

$\boxed{(xyz)_r \quad xr^2 + yr^1 + zr^0}$

$\boxed{7 \times 8 + 5 \times 8^0}$

$56 + 5 = 61$

$(142)_b + (112)_{b-2} = (75)_8$

$b^2 + 4b + 2 + (b-2)^2 + (b-2) + 2 = 61$

$b^2 + \cancel{4b} + 2 + b^2 + 4 - \cancel{4b} + b - \cancel{2} + \cancel{2} = 61$

$2b^2 + b + 6 = 61$

$b = 5$

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13

1. The following program is stored in the memory unit of the basic computer. Give the content of accumulator register in hexadecimal after the execution of the program.

Location	Instruction
010	CLA
011	ADD 016
012	BUN 014
013	HLT
014	AND 017
015	BUN 013
016	C1A5
017	93C6

AC = 0

AC = 0 + C1A5

AC = C1A5

C1A5
93C6

1100 0001 1010 0101
1001 0011 1100 0110

1000 0001 1000 0100

8 1 8 4

8184 (AC)

A. A1B4
B. 81B4
C. A184
D. 8184

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14 Consider the equation $(146)_b + (313)_{b-2} = (246)_8$. Which of the following is the value of b?

A. 8

B. 7

C. 10

D. 16

$$1\times b^2 + 4b + 6 + 3(b-2)^2 + (b-2) + 3$$

$$b^2 + 4b + 6 + 3(b^2 + 4 - 4b) + b - 2 + 3 = 166$$

$$b^2 + 4b + 6 + 3b^2 + 12 - 12b + b - 2 + 3 = 166$$

$$4b^2 - 7b + 19 = 166$$

$$b = 7$$

$(246)_8$

$2\times 8^2 + 4\times 8 + 6$

$128 + 32 + 6$

$(166)_{10}$

49×4

196

119

215

49

166

15 How many address lines and data lines are required to provide a memory capacity of 16K × 16?

A. 10, 4 B. 16, 16
C. 14, 16 D. 4, 16

$2^k \times n$

$16K \times 16$

$2^{14} \times 16$

k - Address Lines

n - data Lines

14 - Address

16 - data

Problem solving of previous NET papers

16 In computers, subtraction is generally carried out by

A. 9's complement
B. 1's complement
C 10's complement
D. 2's complement

$A - B = A + (\bar{B} + 1)$

2's Complement

Problem solving of previous NET papers

17

Consider the following Boolean equations:

i. $wx + w(x + y) + x(x + y) = x + wy$

ii. $\left(w\bar{x}\left(y+x\bar{z}\right)+\bar{w}\ \bar{x}\right)y=\bar{x}\ y$

What can you say about the above equations?

A. i is true and ii is false

B. i is false and ii is true

C. Both i and ii are true

D. Both i and ii are false

i is true

$$wx + w(x+y) + x(x+y) = x + wy$$

$$wx + wx + wy + x + xy$$

$$wx + wy + x[1+y]$$

$$wx + wy + x$$

$$(w+1)x + wy$$

$$x + wy$$

$$w\bar{x}yy + \bar{w}\bar{x}y$$

$$w\bar{x}y + \bar{w}\bar{x}y$$

$$w+\bar{w}(\bar{x}y)$$

$$\bar{x}y$$

$$(w\bar{x}y + \bar{w}\bar{x})y$$

$$(wy+\bar{w})\bar{x}\cdot y$$

$$(w+\bar{w})(y+\bar{w})\bar{x}\cdot y$$

$$(y+\bar{w})\bar{x}y$$