| α | | |
|----------|--|--|
| 1000 | | |
| Class: | | |

ID: _____

Name:

1. (7%) Convert 144.6₇ to the one with base 5.

A: 311.412032

2. (6%)(a)(3%) Express (-90) with an 8-bit number using 2's complement for negative number. (b)(3%) What is the range of numbers that N-bit 1's complement number system can represent?

A: (a) 10100110 (b) $2^{(N-1)} \sim -2^{(N-1)}+1$

3. (7%) Assume we use 2's complement to represent negative number. Is the addition as shown in Fig. 1 valid (not overflow)? Translate to decimal addition if YES, otherwise explain the reason (why overflow).

A: No, because (-26)+(-10)=(-36), it overflows

Fig. 1

4. (6%) The minimum SOP form of $\underline{F}=(X+Y)(Y+Z)(X'+Z)$ has m terms. The minimum POS form of $\underline{G}=YZ+X'Z+XY$ has n terms. How many switch functions of (m+n+1) variables are there?

A: $m=n=2, 2^2(m+n+1)=2^32$

5. (6%) Show the procedure of the addition (-10) +(-22) with 6-bit binary number. Also indicate the result in decimal. Using 2's complement for negative number.

(-10)+(-22)=(-32), -32=100000

A:

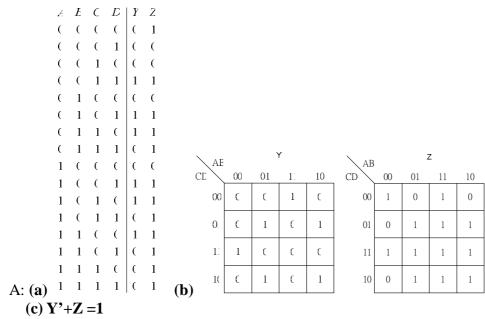
6. (7%) Factor the expression <u>ABC + BDE' + ABF'+G</u> to obtain a POS form.

A:
$$(B+G)(A+D+G)(A+E'+G)(C+D+F'+G)(C+E'+F'+G)$$

7. (9%) Use K-Map to simplify the expression $F = ABC' + (A'C' \equiv B) + (C \oplus AD) + ABCD$ to a minimum SOP form.

A:A+B+C

8. (16%) A combinational network has 4 inputs A, B, C, D and two outputs Y, Z. The output Y is 1 if and only if two inputs are 1. The output Z is 0 if and only if one input is 1.(a)(4%) Draw the truth tables of Y, Z. (b)(4%) Plot the K-Map of Y, Z. (c) (4%) What is the Boolean function of Y'+ Z? (d)(4%)What is the physical meaning of Y ⊕Z (ex: the physical meaning of Y is if and only if two inputs are 1)?



(d) the number of inputs equals 1 or 2, the output =1

9. (12%) Given an N-input function $F = \prod M(a, b, c)$, $0 \le a, b, c \le 2^N-1$, $a \ne b \ne c$. (a)(5%) Express F' by maxterm expansion. (b)(7%) Express F^D (duality of F) by minterm expansion.

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A: (a)F' = $\prod M(i)$, i from 0~2^N-1, but $i\neq a\neq b\neq c$ (b) $F^D = \sum m(2^N-1-a,\ 2^N-1-b,\ 2^N-1-c)$

10. (7%) Assume that the inputs ABCD = 0110, 1001, 1011, 1000 never occur, find the minimum SOP form of $\underline{F} = \underline{A'B'D} + \underline{A'CD} + \underline{BD} + \underline{ABCD'}$.

A:F=D+BC

11. (5%) Use Boolean algebraic operations to show that $\underline{WX+XY+X'Z'+WY'Z'=}$ $\underline{WX+XY+X'Z'}$.

A: omitted

12. (6%) What are the values of m_i AND m_j , M_i OR M_j , if $i \neq j$?

A: m_i AND $m_j=0$, M_i OR $M_j=1$

13. (6%) Why can Carry Lookahead Adder and Carry Select Adder speedup the addition operation?

A: omitted

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