UNIVERSITY OF SWAZILAND

FACULTY OF SCIENCE
DEPARTMENT OF PHYSICS

SUPPLEMENTARY EXAMINATION 2005

Title of the Paper: **DIGITAL ELECTRONICS**

Course Number: **P411**

Time Allowed: **Three Hours**.

Instructions:

1. Answer any five questions.
2. Each question carries 20 points

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QUESTION 1:

a Transform the Boolean function, $F = BE + \overline{B}D\overline{E}$, into
(1). a K-map,
(2) a function in the following format:
F(A, B, C, D, E)= Σ(n1, n2, - - -, nB, nC, - - -,n1F)
The number in the above brackets must be hexadecimal.
(hint, expand this function into canonical form first.) **10pts:**

b Using the tabulation method, simplify the following Boolean function F into an SOP:
F(v, w, x, y, z)= Σ(2, 6, 9, D, 12, 13, 16, 17, 19, 1D, 1F)
(hex number in the brackets of the above function) **10pts:**

QUESTION 2:

a With the help of a K-map, obtain the simplified expression of the Boolean Function in only SOP

$$F = (\overline{A} + \overline{B} + D)(A + B + \overline{D})(A + \overline{B} + C + D)(\overline{A} + \overline{D})$$ **10pts:**

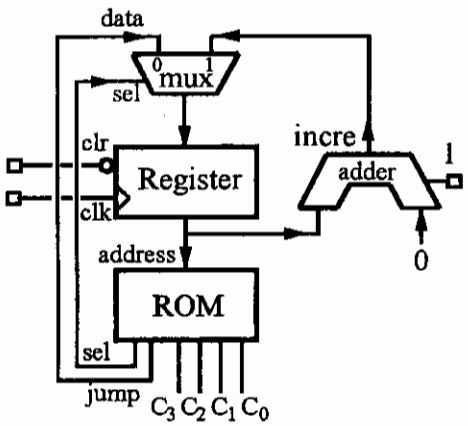
b Implement the Boolean function, $F = (A + \overline{B})(CD + E)$,with only NOR gates and nothing but NOR gates. Complement inputs are available only at input terminals, nowhere else. The implement must have its function support. **10pts:**

QUESTION 3:

a Implement the following function with a multiplexer of 8-1 (must have this component) and other elementary gates.
$F(v, w, x, y)= \Sigma(0, 3, 5, 8, 9, D, F)$ **10pts:**
(hex number in the brackets of the above function)

b Fig. 3 is a microprogrammed sequencer. In the ROM, there are fields in a byte: jumping address, mux select address, and sequence output, C. The sequencer starts at address 0000 and finally jumps back to 0000. What is the output C just before jumping back to 0000. And give the sequence of address that the processor runs through. **10pts:**

Fig. 3



ROM addr	ROM contents		
	sel	jump	C
0	1	6	A
1	1	3	2
2	0	9	4
3	0	A	7
4	1	7	C
5	1	A	F
6	1	9	9
7	0	0	4
8	1	0	1
9	1	8	3
A	0	E	E
B	1	9	5
C	1	0	D
D	1	B	0
E	0	4	0
F	x	4	6

QUESTION 4:

Design a sorting circuit for two 3-bit codes, $B_2B_1B_0$ and $A_2A_1A_0$. Compare two codes to find out "B>A". Design the circuit to fit in a PLA. The circuit must have its function support. (hint, using logical inference, or an 8x8 K-map, or an abridged truth table.) **20pts:**

QUESTION 5:

Design, with D-ff's, a clocked sequencer to cycle repeatedly through the states: - - - 0, 1, 2, 0, 1, 2, 3, 4, 5, 3, 4, 5 - - -. Obtain a logic circuit, a state table, a state diagram, and ff input functions. (hint: need a hidden unit)

20pts:

QUESTION 6:

Design a sequential machine, with no restriction on the use of any logic components. Its ASM diagram is shown in Fig. 6 below. Obtain a state transition table, and a circuit diagram plus the support of the logic equations. Two D-ff's are proper to use **20pts:**

Fig. 6, ASM diagram