

Open book. 70 minutes

In the spirit of the code of honor of Carleton University I solemnly declare this examination is completely my own work, and I did not aid my answer to any question by dishonorable means.

NAME _____ STUDENT No _____

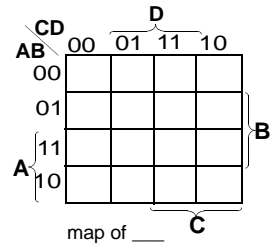
Write answers on the question sheet. Use additional paper if necessary. Attempt all questions.

1

a) Given $F = (\bar{E} \cdot \bar{F} + G)(A \cdot B + H) + C \cdot D$

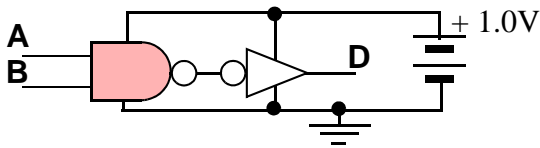
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- i) Find F_{dual}
- ii) Find the inverse \bar{F} with overlines over only single letters.



b) The CMOS gates shown run from a 1.0V power supply.

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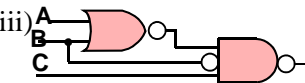
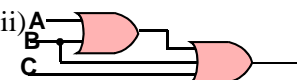
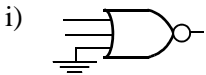


Calculate the value of D for the inputs shown, if you can't calculate an answer write don't know (or DK for short) and explain why.

	i)	ii)	iii)	iv)	v)	
A	0.0	0.8	0.8	0.6	1.0	volts
B	1.0	0.2	0.9	0.2	0.5	volts
D						volts

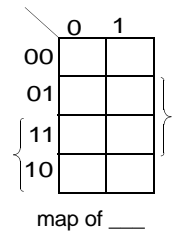
c) Draw the simplest 3-input gate, 2-input gate, 1-input gate, or less, that are logically equivalent to the each of following:

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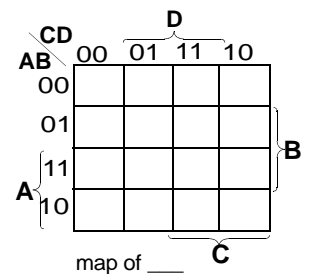
d) Simplify $H = (B + C + D) \cdot \overline{(B + C)}$

6%



e) Simplify $G = (C + \bar{D}) \cdot (B + C \cdot D) \cdot (B + D) + E \cdot A$

11%



2 Two's Complement

17%

Use two's complement binary arithmetic, to do the adjacent 4-bit subtraction. Show the answer as a two's complement number.
$$\begin{array}{r} 0111 \\ - 1010 \\ \hline \end{array}$$

The 4 bit sum _____

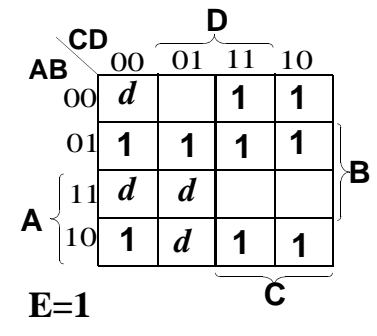
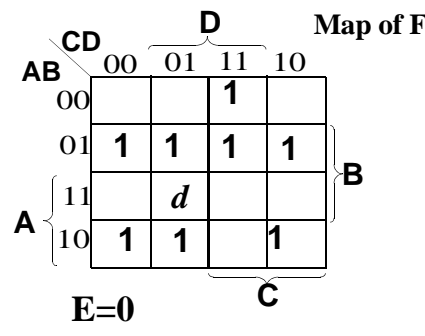
The sum with sign extension _____

For a 4-bit machine: Will have overflow , No overflow

3 Find an algebraic expression for the five-variable function F which requires minimum gates, and then minimum gate inputs. Blanks are zeros. The "d"'s are don't cares.

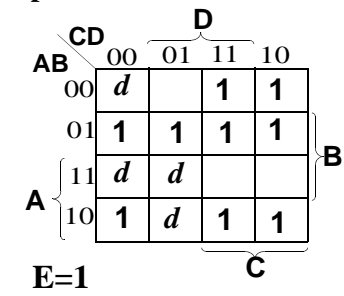
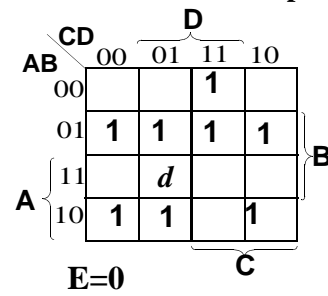
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Cross out any wrong maps



Answer
F =

Spare Map of F



4 Timing Diagram

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Given the circuit shown below, draw a timing diagram for signals X, Y and Z. The RST is asynchronous..

