

Jetic Gū

1. Handwritten submissions and proprietary formats (e.g. Pages or MS Word) **will not be graded**.
2. Resubmissions are subject to **20% penalty per day** pass the date of grade release.
3. Mathematical expressions must be written entirely using LaTeX, otherwise **50%-100%** of marks will be deducted.
4. Circuits must be **tested** using switches/probs against a truth table. Untested circuits will receive 0.

Submission File structure:

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submission.zip
  - answer.pdf
  - c5.cct
  - c6.cct

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The circuit files are 2.5pt each, the PDF is worth 10pt.

Lab 1

1. Work on the following boolean equations (2pt).
 - A. Use a truth table to prove: $\overline{X + Y + Z} = \overline{X} \overline{Y} \overline{Z}$
 - B. Use DeMorgan's Theorem, express the following with only OR and complement (NOT): $\overline{BC} + \overline{A} \overline{C}$
2. Use algebraic manipulation to prove (4pt).
 - A. $\overline{X} \overline{Y} + \overline{X} Y + X Y = \overline{X} + Y$
 - B. $Y + \overline{X} Z + X \overline{Y} = X + Y + Z$
 - C. $W Y + \overline{W} Y \overline{Z} + W X Z + \overline{W} X \overline{Y} = W Y + \overline{W} X \overline{Z} + \overline{X} Y \overline{Z} + X \overline{Y} Z$
 - D. $A \overline{D} + \overline{A} B + \overline{C} D + \overline{B} C = (\overline{A} + \overline{B} + \overline{C} + \overline{D})(A + B + C + D)$
3. Optimise the following boolean functions using K-maps (2pt).
 - A. $F(A, B, C, D) = \Sigma m(0, 2, 4, 5, 8, 10, 11, 15)$
 - B. $F(A_3, A_2, A_1, A_0) = \Sigma m(0, 1, 2, 4, 5, 6, 10, 11)$
4. The denotation of don't care condition is $d(\dots) = \Sigma m(\dots)$ complimenting the boolean function F . Optimise the following Boolean function F together with the don't care condition d (2pt).
 - A. $F(A, B, C) = \Sigma m(2, 4, 7)$, $d(A, B, C) = \Sigma m(0, 1, 5, 6)$
 - B. $F(A_3, A_2, A_1, A_0) = \Sigma m(4, 6, 7, 8, 12, 15)$, $d(A_3, A_2, A_1, A_0) = \Sigma m(2, 3, 5, 10, 11, 14)$
5. Implement the following boolean expression in LogicWorks, save it as c5.cct (2.5pt).

$$F(A, B, C) = AB + A\overline{C} + B\overline{C}$$

6. Implement the following boolean expressions as a single circuit in LogicWorks, save it as c6.cct (2.5pt).

$$S(X, Y, Z) = X \oplus Y \oplus Z$$

$$C(X, Y, Z) = XY + (X \oplus Y)Z$$

