Jetic Gū

Columbia College

You must complete the following assignment and submit a PDF of relevant questions. Handwritten submissions and proprietary formats (e.g. Pages or MS Word) will not be accepted. You will also need to upload LogicWork circuit design file. Then upload a single ZIP file to Moodle.

Submission File structure:

```
submission.zip
    — answer.pdf
    — circuit2a.cct
    — circuit2b.cct
    — circuit4a.cct
    — circuit4b.cct
```

The circuit files are 2.5pt each, while the PDF portion is 10pt in total.

Lab 1

1. Work on the following boolean equations (2.5pt).
   - A. Using truth table to prove: $\overline{XYZ} = \overline{X} + \overline{Y} + \overline{Z}$
   - B. Use DeMorgan's Theorem, express the following with only OR and complement (NOT): $A\overline{B}C + \overline{A}\,\overline{C} + AB$
   - C. Simplify using algebraic manipulation: $AB\overline{C} + AC$
   - D. Simplify using algebraic manipulation: $\overline{A + B + C} \cdot \overline{ABC}$
2. Optimise the following boolean functions using a K-map (2.5pt), then implement the circuit in logic works as `circuit2a.cct` and `circuit2b.cct`. You must **clearly label your input** according to the variables here, and you must clearly label your output prob as *F*.
   - A. $F(A, B, C, D) = \Sigma m(0,2,5,6,8,10,13,14,15)$
   - B. $F(A, B, C, D) = \Sigma m(0,2,5,8,9,10,11,12,13)$
3. Optimise the following boolean expressions into Product-of-Sums form. (2.5pt)
   - A. $F(A, B, C, D) = \Sigma m(0,2,3,4,8,10,11,15)$
   - B. $F(W, X, Y, Z) = \Pi M(0,2,4,5,8,10,11,12,13,14)$
4. The denotation of don't care condition is $d(A, B, C, D) = \Sigma m(\ldots)$ complimenting the boolean function F. Optimise the following Boolean function F together with the don't care condition d. (2.5pt) Implement the two boolean expressions in LogicWorks, save as `circuit4a.cct` and `circuit4b.cct`. You must **clearly label your input** according to the variables here, and you must clearly label your output prob as *F*.
   - A. $F(A, B, C, D) = \Sigma m(1,3,4,6,9,11)$, $d(A, B, C, D) = \Sigma m(0,2,5,8,10,12,14)$
   - B. $F(A, B, C, D) = \Sigma m(3,4,9,15)$, $d(A, B, C, D) = \Sigma m(0,1,2,5,10,12,14)$