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This assignment is due on 10 October. 2021

Please remember to write your name and student number.

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. Prove the following boolean equations (2.5pt).

    A. Using algebraic manipulation: $A(\overline{A} + B)(\overline{A B} + C)(\overline{A B C} + D) = A B C D$

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 switches** according to the variables here, and you must clearly label your output prob as *F*.

    A. $F(A, B, C, D) = \Sigma m(2,3,8,9,10,12,13,14)$

    B. $F(A, B, C, D) = \Sigma m(1,3,6,7,9,11,12,13,15)$

3. Optimise the following boolean expressions in 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 $d(A, B, C, D) = \Sigma m(\dots)$ 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 switches** according to the variables here, and you must clearly label your output prob as *F*.

    A. $F(A, B, C, D) = \Sigma m(0,1,7,13,15), d(A, B, C, D) = \Sigma m(2,4,6,8,9,10)$

    B. $F(A, B, C) = \Sigma m(1,2,4), d(A, B, C) = \Sigma m(0,3,6,7)$