

Lab Exercise 3 – Karnaugh Maps

Due : Friday, January 30, 2026

Question 1. SOP Karnaugh Maps [10 marks]

Karnaugh maps are often used to **obtain simplified Sum of Product (SOP) expressions**. Process each of the SOP expressions below, using Karnaugh maps. Each expression uses *canonical minterm* notation that may be used to fill in the K-map.

$$F(X,Y,Z) = \sum m(0,2,5,7)$$

$$G(A,B,C,D) = \sum m(1,3,4,6,9,11,12,14)$$

Question 2. POS Karnaugh Maps [10 marks]

Karnaugh maps are also used to **obtain simplified Product of Sums (POS) expressions**. Process each of the expressions below, using Karnaugh maps. Each expression uses either *canonical minterm* (SOP) or *canonical maxterm* (POS) notation that may be used to fill in the K-map.

$$H(X,Y,Z) = \prod M(0,2,6)$$

$$L(A,B,C,D) = \sum m(4,6,7,15)$$

Question 3. Don't Care Conditions in Karnaugh Maps [10 marks]

Simplify the Boolean function F together with the don't-care conditions dc in **(1) SOP form** and **(2) POS form**. Use the don't-care conditions to obtain expressions with the minimum number of literals.

$$F(W,X,Y,Z) = \sum m(0,1,2,3,7,8,10)$$

$$dc(W,X,Y,Z) = \sum m(5,6,11,15)$$

Question 4. [10 marks]

Optimize the following Boolean expressions using a map:

$$F(W,X,Y,Z)=\sum m(0,1,2,4,7,8,10,12)$$

Question 5. [10 marks]

Obtain Truth table of the following function and express each function in Sum of Minterms and Product of Maxterms form:

$$WXY'+WXZ'+WXZ+YZ'$$

Additional Assigned Reading and Self-study Exercises:

Review and attempt all problems at the end of Chapter 2 in the textbook. It is not required that students submit their work, nor will it be evaluated. However, examination questions may be based on these problems, so it is worthwhile to complete this work.

FINAL NOTES:

Submission:

- A. Submit the lab work on Brightspace before the deadline.
- B. Students are responsible for uploading the work in high resolution when submitted as images.
- C. No extensions will be granted. Students are provided five days to complete the assignment, and it is student's responsibility to manage the time and complete the assignment before the submission deadline.

Evaluation:

- A. Students are evaluated on all stated requirements.
- B. It is mandatory that students complete their work and must be able to justify their answers when asked to do so by instructors and teaching staff.
- C. If the work is not clearly written or presented, or submission is in unsupported file type, it will be graded as zero.