

CS 350 Activities for Lecture 7

Activity 7.1: Expressions for Karnaugh Map Implicants

A. Why?

- Karnaugh maps can help us simplify boolean expressions.

B. Outcomes

At the end of this activity you should:

- Be able to take a Karnaugh map implicant and give the expression it corresponds to

C. Questions

For each of the following Karnaugh maps, (a) What expressions correspond to the implicants shown? (b) Which implicants aren't prime and how can they be extended to become prime? (c) Is there a way to reduce the number of implicants?

1.

X	Y	Z
0	0	1
0	1	1
1	1	1
1	0	0

- (a) $\bar{X}\bar{Y}$ and Y (b) $\bar{X}\bar{Y}$ becomes \bar{X}
[whole expr is $\bar{X} + Y$] (c) no

2.

		Y	
		0	1
X	0	1	1
	1	1	0

- (a) $\bar{X}\bar{Y}$, $X\bar{Y}$, and \bar{X} . (b) combine $\bar{X}\bar{Y}$, $X\bar{Y}$ to vertical pair \bar{Y} . (c) combination in (b) gave us 2 implicants.

3.

		YZ			
		00	01	11	10
X	0	0	1	1	1
	1	1	1	0	1

- (a) $X\bar{Z}$, $\bar{Y}Z$, $\bar{X}YZ$, $Y\bar{Z}$.
(b) Change $\bar{X}YZ$ to $\bar{X}Z$ or $\bar{X}Y$
(c) Can't reduce # implicants

4.

		YZ			
		00	01	11	10
X	0	0	1	1	1
	1	1	1	0	1

Activity 7.2: Karnaugh Maps for Expressions in DNF

A. Why?

- Drawing a Karnaugh map for an expression in disjunctive normal form is an important special case of drawing Karnaugh maps in general.

B. Outcomes

At the end of this activity you should:

- Be able to take a boolean expression in disjunctive normal form and rewrite it as a Karnaugh map.

C. Questions

For each of the following expressions, draw a Karnaugh map and circle the 1s for each of the implicants. Not all of the disjuncts have the maximum number of atoms, so the implicants may overlap.

1. $XY + X\bar{Y} + Y$
2. $X + XYZ + X\bar{Z} + Y\bar{Z}$
3. $V + XY + \bar{X}\bar{Y}\bar{Z} + VXYZ$

Activity 7.3: Simplifying Expressions Using Karnaugh Maps

A. Why?

- Karnaugh maps can help us simplify boolean expressions.

B. Outcomes

At the end of this activity you should:

- Be able to simplify a boolean expression using Karnaugh maps.

C. Questions

1. Simplify $(XY + X\bar{Y} + Y)$ using Karnaugh maps: Draw a 2-variable map for the expression, find (circle) prime implicants to exactly cover it, and give the expression specified by the implicants.
2. Simplify $(X + Y)(X + Z) + \neg(\bar{X}\bar{Z})$ using Karnaugh maps.
3. Simplify $\neg(XZ) + V(XYZ + \bar{X}\bar{Z})$ using Karnaugh maps.