

Chapter 8.2: Syntactic Logic Coverage Criteria (DNF)

Complete the problems below and submit this word document with your answers.

<u>What to do?</u>	<u>Extra Credit:</u>
Use two predicates below and answer the following questions for each of them.	This is optional. You will receive up to 20 points for this part. Use the predicate below and answer the following questions for this predicate.
1) $f = ab + \bar{a}\bar{b}c + \bar{a}\bar{b}\bar{c}$ 2) $f = \bar{a}\bar{c}\bar{d} + \bar{c}d + bcd$	3) $f = ab + \bar{a}c + a\bar{c}$

- Draw Karnaugh maps for f and \bar{f}
- Find the DNF non-redundant prime implicant representation for f and \bar{f}
- Give a test set that satisfies Implicant Coverage (IC) for f
- Give a test set that satisfies Multiple Unique True Point (MUTP) for f
- Give a test set that satisfies Corresponding Unique True Point and Near False Point Pair Coverage (CUTPNFP) for f
- Give a test set that satisfies Multiple Near False Points (MNFP) for f
- Give a test set that is guaranteed to detect all DNF faults (i.e., MUMCUT)

Homework 6

Devansh Amin

① $f = ab + a\bar{b}c + \bar{a}\bar{b}c$

a) For f ,

ab		00	01	11	10
c	0			T	
	1	T		T	T

For \bar{f} ,

ab		00	01	11	10
c	0	T	T		T
	1		T		

b) For f ,
 $f = ab + \bar{b}c$

For \bar{f} ,
 $\bar{f} = \bar{a}b + \bar{b}\bar{c}$

c) Implicant coverage (IC)

	a	b	c
ab	T	T	
$\bar{b}c$		F	T
$\bar{a}b$	F	T	
$\bar{b}\bar{c}$		F	F

Implicants

$$\{ ab, \bar{b}c, \bar{a}b, \bar{b}\bar{c} \}$$

Final minimized
Test set:

$$\{ TT-, -FT, FT-, -FF \}$$

d) MUTP

Test set: $\{ TTF, TTT, FFT, TFT \}$

e) CUTPNFP

For implicant ab ,

	UTP	NFP
a	TTF	FTF
b	TTF	TFF

For implicant $\bar{b}c$,

	UTP	NFP
\bar{b}	FFT	FTT
c	FFT	FFF

Possible CUTPNFP test sets

$\{ TTF, FFT \} \rightarrow$ UTPs

$\{ FTF, TFF, FTT, FFF \} \rightarrow$ NFPs

f) MNFP

For implicant ab ,

- NFPs
- $a \rightarrow FTF, FTT$
 - $b \rightarrow TFF, TFT$

For implicant $\bar{b}c$,

- NFPs
- $\bar{b} \rightarrow FTT, TTT$
 - $c \rightarrow FFF, TFF$

Test set

$\{ FTT, FFF, TTT, TFF, FTF, TFT \}$

②

9) MUMCUT

MUTP $\rightarrow \{ TTF, TTT, FFT, TFT \}$

CUTPNFP $\rightarrow \{ TTF, FFT \} \rightarrow UTPs$
 $\{ FTF, TFF, FTT, FFF \} \rightarrow NFPs$

MNFP $\rightarrow \{ FTT, FFF, TTT, TFF, FTF, TFT \}$

MUMCUT Test Set

$\{ TTF, TTT, FFT, TFT, FTF, TFF, FTT, FFF \}$

② $f = \bar{a}\bar{c}\bar{d} + \bar{c}d + bcd$

a) For f ,

For \bar{f} ,

cd \ ab	00	01	11	10
00	T	T		
01	T	T	T	T
11		T	T	
10				

cd \ ab	00	01	11	10
00			T	T
01				
11	T			T
10	T	T	T	T

b) For f ,

$$f = \bar{a}\bar{c} + \bar{c}d + bd$$

For \bar{f} ,

$$\bar{f} = a\bar{d} + \bar{b}c + c\bar{d}$$

c) Implicant Coverage (Ic)

	a	b	c	d
$\bar{a}\bar{c}$	F		F	
$\bar{c}d$			F	T
bd		T		T
$a\bar{d}$	T			F
$\bar{b}c$		F	T	
$c\bar{d}$			T	F

Implicants
 $\{ \bar{a}\bar{c}, \bar{c}d, bd, a\bar{d}, \bar{b}c, c\bar{d} \}$

Final minimized
 Test set :
 $\{ FTFT, TFTF \}$

d) MUTP

Test set

{ FTFF, FFFT, TFFT, FTFT, TTFT, FT TT }

e) CUTPNFP

For implicant $\bar{a} \bar{c}$,

	UTP	NFP		UTP	NFP
\bar{a}	FFFA	TFFA	\bar{a}	FTFF	TTFF
\bar{c}	FFFF	FFTF	\bar{c}	FTFF	FTTF

For implicant $\bar{c} d$,

	UTP	NFP
\bar{c}	TFFT	TFTT
d	TFFT	TFFF

For implicant bd ,

	UTP	NFP
b	FTTT	FTTT
d	TTTT	TTTF

Possible CUTPNFP test set

{ FTFF, TFFT, FT TT, TT TT } \rightarrow UTPs

{ TTFF, FTTF, TFTT, TFFF, FT TT, TTTF } \rightarrow NFPs

f) MNFP

For implicant $\bar{a}\bar{c}$

- NFPs
- $\bar{a} \rightarrow T T F F, T F F T$
 - $\bar{c} \rightarrow F T T F, F F T T$

For implicant $\bar{c}d$

- NFPs
- $\bar{c} \rightarrow T F T T, F T T T$
 - $d \rightarrow T F F F, F T F F$

For implicant bd

- NFPs
- $b \rightarrow T F F T, F F T T$
 - $d \rightarrow T T F F, F T T F$

Test Set

$\{ T T F F, T F F T, F T T F, F F T T, T F T T, F T T T, T F F F, F T F F \}$

g) MUMCUT

MUTP Test Set $\{ F T F F, F F F T, T F F T, F T F T, T T F T, F T T T \}$

CUTPNFP Test Set

$\{ F T F F, T F F T, F T T T, T T T T \} \rightarrow UTPs$

$\{ T T F F, F T T F, T F T T, T F F F, F F T T, T T T F \} \rightarrow NFPs$

MNFP Test Set { TTFF, TFFT, FTTF, FFTT,
TFTT, FT TT, TFFF, FTFF }

MUMCUT Test Set

{ FTFF, FFFT, TFFT, FTFT, TTFT, FT TT,
TTTT, TTFF, FTTF, TFFT, TFFF,
FFTT, TTTF. }

Extra credit.

③ $f = ab + \bar{a}c + a\bar{c}$

a) for f ,

c \ ab	00	01	11	10
0			T	T
1	T	T	T	

for \bar{f} ,

c \ ab	00	01	11	10
0	T	T		
1				T

b) $f = \bar{a}c + ab + a\bar{c}$

$\bar{f} = \bar{a}\bar{c} + a\bar{b}c$

c) Implicant coverage (IC)

Implicants

$\{ \bar{a}\bar{c}, ab, a\bar{c}, \bar{a}\bar{c}, a\bar{b}c \}$

	a	b	c
$\bar{a}c$	F		T
ab	T	T	
$a\bar{c}$	T		F
$\bar{a}\bar{c}$	F		F
$a\bar{b}c$	T	F	T

Final minimized

Test set

$\{ F-T, F-F, TTF, TFT \}$

d) MUTP

Test set $\{TFF, TTF, TTT, FFT, FTT\}$

For $a\bar{c}$,

— TFF, TTF

For ab ,

— TTT, TTF

For $\bar{a}c$,

— FFT, FTT

e) CUTPNFP

For implicant $a\bar{c}$,

	UTP	NFP	
a	TFF	FFF	✓
\bar{c}	TFF	TFT	✓

For implicant ab ,

	UTP	NFP	
a	TTT	FTT	x
b	TTT	TFT	x

Not possible.

For implicant $\bar{a}c$,

	UTP	NFP	
\bar{a}	FFT	TFT	x
	FTT	TTT	x
c	FTT	FTF	✓

Not possible.

Possible CUTPNFP test set

$\{TFF, FTT\} \rightarrow$ UTPs

$\{FFF, TFT, FTF\} \rightarrow$ NFPs

f) MNFP

For implicant $a\bar{c}$,

NFPs

- $a \rightarrow FFF, FTF$
- $\bar{c} \rightarrow TFT, TTT$

For implicant ab ,

NFPs

- $a \rightarrow FTT, FTF$
- $b \rightarrow TFT, TFF$

For implicant $\bar{a}c$,

NFPs

- $\bar{a} \rightarrow TFT, TTT$
- $c \rightarrow FTF, FFF$

Test set

$\{TFT, FTF, TTT, FFF, FTT, TFF\}$

g) MUMCUT

Test set

$\{TFF, TTF, TTT, FFT, FTT, FFF, TFT, FTF\}$