



Unit 11 - Binary Decision Diagram and Symbolic model checking

Course outline

How to access the portal ?

Introduction and Overview of VLSI Design

Scheduling in High-Level Synthesis

Resource Sharing and Binding in HLS

Logic Synthesis

Physical Design

Introduction to Verification Techniques

Syntax and semantics of CTL, Equivalences between CTL formulas and Introduction to Model Checking

CTL Model checking Algorithms and Introduction to Binary Decision Diagrams

Binary Decision Diagram and Symbolic model checking

- ☐ Ordered Binary Decision Diagram (OBDD)

Week 8--Assignment

The due date for submitting this assignment has passed. **Due on 2016-09-18, 23:58 IST.**

Submitted assignment

1) Let B_X and B_Y are two ROBDDs representing Boolean function $f(a,b,c)=a'b+ac+bc'$ with variable ordering $\langle a, b, c \rangle$ and $\langle c, a, b \rangle$ respectively. Count the number of nodes in B_X and B_Y . 2 points

- ☐ $B_X=5, B_Y=5$
☐ $B_X=5, B_Y=6$
☐ $B_X=6, B_Y=5$
☐ $B_X=6, B_Y=6$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$B_X=6, B_Y=5$

2) Consider the Boolean function of 2-bit comparator, $f(a_1, a_2, b_1, b_2) = (a_1 \text{ XNOR } b_1) \cdot (a_2 \text{ XNOR } b_2)$. Draw ROBDD to represent f with variable ordering $\langle a_1, a_2, b_1, b_2 \rangle$ and find the number of nodes in it. 2 points

- ☐ 10
☐ 11
☐ 12
☐ 14

No, the answer is incorrect.

Score: 0

Accepted Answers:

11

3) Let $f(a,b)=a'b'+a'b+ab'+ab$ be a Boolean function . Which of the followings is true? 1 point

- ☐ f is independent of only a
☐ f is independent of only b
☐ f is independent of both a and b
☐ None of the above

No, the answer is incorrect.

Score: 0

- ☐ Operation On OBDD
- ☐ OBDD for state transition systems
- ☐ Symbolic model checking
- ☐ Quiz : Week 8-- Assignment

Introduction to Digital Testing

Fault Simulation and Testability Measures

Combinational Circuit Test Pattern Generation

Sequential Circuit Testing and Scan Chains

Built In Self Test (BIST)

Accepted Answers:

f is independent of both a and b

4) Let $f(a,b,c)=a'b'+abc+a'c'$ be a Boolean function. What is the negative Shannon cofactor of f with respect to c ?

1 point

- ☐ a'
- ☐ b'
- ☐ c'
- ☐ $a'b'+ab$

No, the answer is incorrect.

Score: 0

Accepted Answers:

a'

5) Let B_f is a ROBDD of Boolean expression f . If B_f contains only one node and that is labeled with 1, then which of the followings is true for f .

1 point

- ☐ f is not a valid Boolean expression
- ☐ f is not a satisfiable Boolean expression
- ☐ f is a valid Boolean expression
- ☐ None of the above

No, the answer is incorrect.

Score: 0

Accepted Answers:

f is a valid Boolean expression

6) Let B_f be a ROBDD of a Boolean expression f . If there exists 4 paths to terminal node 1 and 3 paths to terminal node 0 in B_f , then what can we say about f .

1 point

- ☐ f is valid but not satisfiable
- ☐ f is valid and satisfiable
- ☐ f is neither valid nor satisfiable
- ☐ f is not valid but satisfiable

No, the answer is incorrect.

Score: 0

Accepted Answers:

f is not valid but satisfiable

7) Let B_f be a OBDD representing Boolean function $f(a,b,c)=a'b+b'c$ and B_g be another OBDD representing Boolean function $g(a,b,c)=a'b$. Perform XOR operation on B_f and B_g (i.e., $B_{XOR} = B_f \text{ XOR } B_g$) and reduce it. Find the number of nodes and number of satisfying assignments in B_{XOR} . Assume order of variables in all cases is $\langle a, b, c \rangle$.

3 points

- ☐ Nodes=4, Satisfying assignments =2
- ☐ Nodes=6, Satisfying assignments =2
- ☐ Nodes=8, Satisfying assignments =3
- ☐ Nodes=6, Satisfying assignments =3

No, the answer is incorrect.

Score: 0

Accepted Answers:

Nodes=4, Satisfying assignments =2

8) Consider the Boolean function $f(a,b,c,d)=ab'c+ab+c'd+bcd$. Construct ROBDD, B_f , to represent f . Construct ROBDDs B_X and B_Y to represent $\text{restrict}(0,c,B_f)$ and $\text{restrict}(1,c,B_f)$, respectively. Finally, construct ROBDD, B_Z , to represent $\text{exists}(c,B_f)$ using B_X and B_Y . Find the number of nodes in B_f , B_X , B_Y and B_Z . Assume order of variables in all cases is $\langle a, b, c, d \rangle$.

3 points

- ☐ $B_f=8, B_X=5, B_Y=5, B_Z=4$
- ☐ $B_f=8, B_X=6, B_Y=6, B_Z=5$
- ☐ $B_f=8, B_X=5, B_Y=5, B_Z=8$
- ☐ None of the above

No, the answer is incorrect.

Score: 0

Accepted Answers:

$B_f=8, B_X=5, B_Y=5, B_Z=4$

9) Let $f(x, y) = x(y + x')$ be a Boolean function. Find the restrictions of f with respect to x .

1 point

- ☐ 0, xy
- ☐ x' , xy
- ☐ 0, y
- ☐ x' , $x+y$

No, the answer is incorrect.

Score: 0

Accepted Answers:

0, y

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