

ECE2031 In-Class Exam A Fall 2002

ANSWER SHEET

Name _____ Section _____

Student No. _____

Closed Books, Closed Notes, No computers or calculators.

Having read the Georgia Institute of Technology Academic Honor Code, I understand and accept my responsibility as a member of the Georgia Tech Community to uphold the Honor Code at all times. In addition, I understand my options for reporting honor violations as detailed in the code.

(Signature)

(Date)

1. a b c Ans: b
2. a b c d e Ans: c
3. a b Ans: b
4. a b c d e Ans: a, c, e
5. a b c d e Ans: b
6. Fill in K-map, circle chosen implicants, and write equation for F:

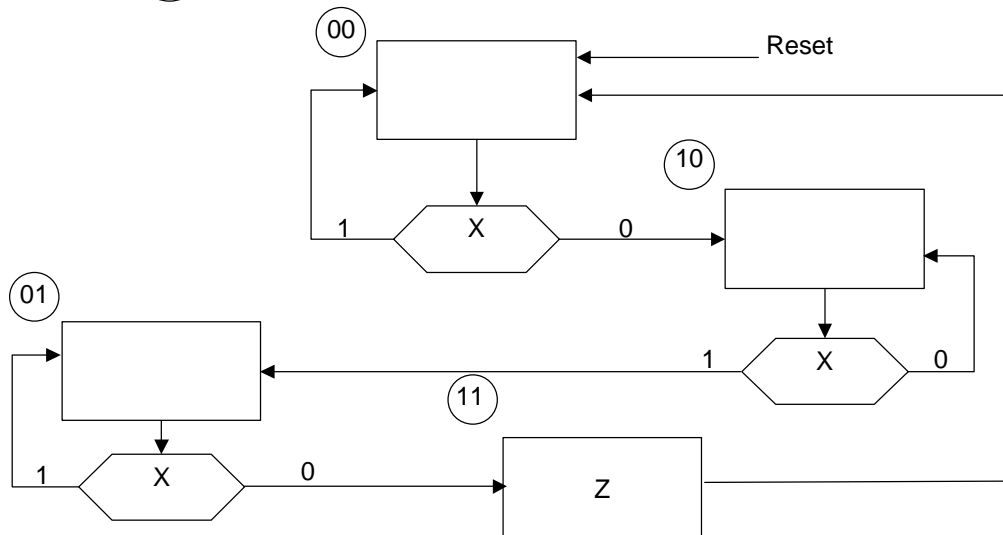
	A	0	1
BC			
00		1	0
01		1	0
11		0	1
10		1	1

$$\bar{A} \bar{B} + A B + B \bar{C} \text{ (Circling same)}$$

F = _____

7. Does it work as it is? YES NO (NO)
 If not, show fix here. (Replace the X=1 transition of state 01 with one going back to 00)

LEGEND: $\textcircled{Q_1Q_0}$



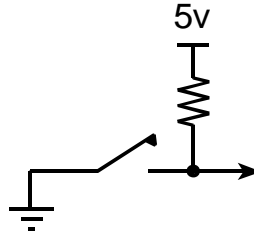
- | | | | | | | |
|-----|---|---|---|---|---|--------|
| 8. | a | b | c | d | e | Ans: b |
| 9. | a | b | c | d | e | Ans: e |
| 10. | a | b | c | d | e | Ans: d |
| 11. | a | b | c | d | e | Ans: c |

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Mark all answers on the answer sheet.

1. (5 pts) The switch shown here is (select one)

- a) active high
- b) active low
- c) neither



2. (5 pts) The switch debouncer used in the lab worked by (select one)

- a) replacing the actual switch
- b) putting the switch output through a T flip-flop in the FLEX chip
- c) waiting until several sequential samples of the switch have the same value
- d) activating some special-purpose hardware on the Altera board, external to the FLEX chip
- e) none of the above

3. (5 pts) Propagation delay is measured from the 10% crossing of an input signal to the 90% crossing of an output signal

- a) TRUE
- b) FALSE

4. (5 pts) Which of the following is a minterm of $F = AB + BC$? (Select all that apply.)

- a) ABC
- b) AB
- c) $A\bar{B}\bar{C}$
- d) $A\bar{B}C$
- e) $\bar{A}BC$

5. (5 pts) To calculate the worst-case propagation delay through a series of logic gates, you use what value for each of the gates in the path? Let t_{PLH} be “low-to-high propagation delay” and t_{PHL} be “high-to-low propagation delay.” (Select one.)

- a) the smaller of the minimum t_{PLH} and the minimum t_{PHL}
- b) the larger of the maximum t_{PLH} and the maximum t_{PHL}
- c) the larger of the typical t_{PLH} and the typical t_{PHL}
- d) the smaller of the minimum t_{PLH} and the maximum t_{PHL}
- e) the average of the typical t_{PLH} and the typical t_{PHL}

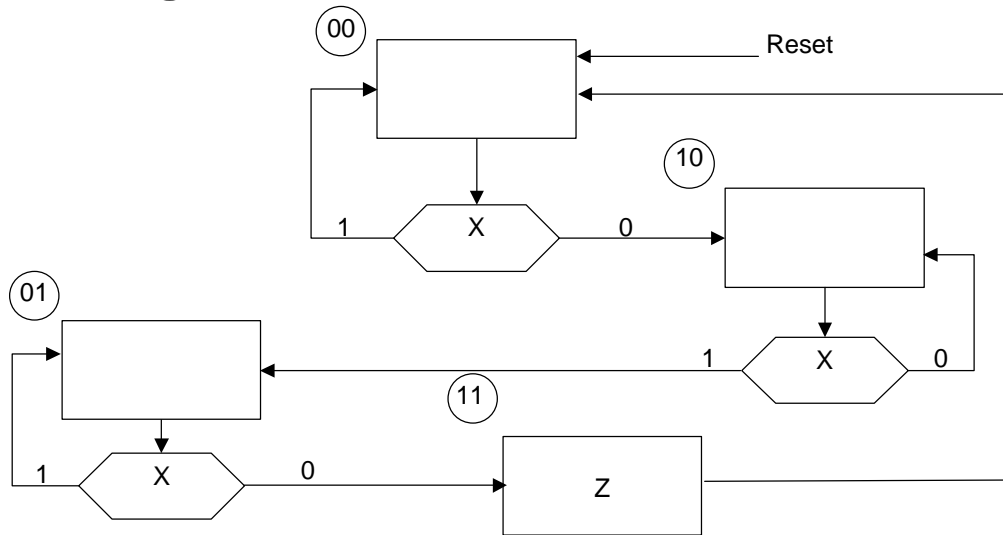
6. (20 pts) For the following truth table, fill in the Karnaugh map on the answer sheet and write the minimal sum of products expression.

A	B	C	F
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	1

7. (20 points) Consider the state machine described by the ASM diagram below, which is based on positive edge-triggered D flip-flops. Note that the state labels represent the two state variables Q1 and Q0, in that order.

The designer intended to create a “sequence detector” that would assert the Z output the first time that successive values of X fit the pattern 0, 1, 0.

LEGEND: $\textcircled{Q_1Q_0}$



Does this work? And if not, show a way to make it work, changing no more than one state transition.

Questions 8-11: On the last page is assembly code very similar to that provided for the first week of robot exercises, with most comments removed. Answer the following questions, based on the results of assembling and running that code on the simple computer.

8. (5 pts) At what address in memory is the instruction labeled Temp?
 - a) H#02
 - b) H#03
 - c) H#04
 - d) H#52
 - e) None of these
9. (5 pts) When is the instruction labeled GO executed? (Select all that apply)
 - a) when the seven-segment display shows the value H#03
 - b) every time the JUMP CheckStatus% instruction is executed, immediately afterwards
 - c) every time the JZERO Go% instruction is executed, immediately afterwards
 - d) when the value read at I/O address H#80 has its lowest bit cleared
 - e) when the value read at at I/O address H#80 has its lowest bit set
10. (5 pts) How is the robot stopped at the end?
 - a) It is not stopped.
 - b) It is told to go to an XPOSITION of zero.
 - c) It is given a velocity command of zero.
 - d) The motors are disabled.
 - e) None of the above.
11. (5 pts) The condition for stopping is the detection of an XPOSITION greater than HALFMETER, a constant selected to be about 0.5 meters. If the robot had been commanded to turn 45 degrees clockwise before being commanded to move forward, about how far would it go before stopping, assuming the ONLY code change is the insertion of the rotation command?
 - a) 0 m
 - b) 0.5 m
 - c) 0.7 m
 - d) 1.0 m
 - e) it would not stop

PROGRAM SOURCE FILE:

TITLE Example Assembly Code (Program Only)
LIST F, W
LINES 50

ENABLE: EQU H#80
VELOCITY: EQU H#81
HEADING: EQU H#82
DELTAHEADING: EQU H#83
; Inputs:
STATUS: EQU H#80
XPOSITION: EQU H#81
YPOSITION: EQU H#82
THETAPOSITION: EQU H#83
LEFTVELOCITY: EQU H#84
RIGHTVELOCITY: EQU H#85
BUMPERS: EQU H#86
SONAR1: EQU H#88
SONAR2: EQU H#89
SONAR3: EQU H#8A
SONAR4: EQU H#8B
SONAR5: EQU H#8C
SONAR6: EQU H#8D
SONAR7: EQU H#8E
SONAR8: EQU H#8F

; Other fixed addresses:
SWITCHES: EQU H#00
SEVENSEG: EQU H#00

; PROGRAM AREA

ORG H#00
Start: LOAD ZERO
ADDI H#01
OUT SEVENSEG
Temp: IN SWITCHES
AND USERPBMASK
JZERO Start%:
CheckStatus: LOAD ZERO
ADDI H#02
OUT SEVENSEG
IN STATUS
AND STATUSMASK
XOR ENABLED
JZERO Go%:
JUMP CheckStatus%:
Go: LOAD ONE
OUT ENABLE
LOAD TWOMPERSEC
OUT VELOCITY
LOAD ZERO
ADDI H#03
OUT SEVENSEG
Goal1: IN XPOSITION
SUBT HALFMETER
JNEG Goal1%:
LOAD ZERO
OUT ENABLE
Stop: JUMP Stop%:
END

; Constants
ZERO: DW H#0000
ONE: DW H#0001
HALFMETER: DW 984
STATUSMASK: DW H#0001
TWOMPERSEC: DW 200
USERPBMASK: DW H#0100
ENABLED: DW H#0001