

ECE2031 In-Class Exam Summer 2007

ANSWER SHEET

Name _____ Section L0 ____ 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)

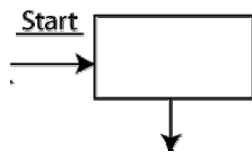
(Date)

CIRCLE YOUR SELECTED ANSWERS OR FILL IN AS NEEDED

1. a b c d e f g h i j k l m n (2 pts)
2. a b c d e f g h i j k l m n (2 pts)
3. a b c d e f g h i j k l m n (2 pts)
4. a b c d e f g h i j k l m n (2 pts)
5. a b c d e f g h i j k l m n (2 pts)
6. a b c d e f g h i j k l m n (2 pts)
7. a b c d e f g h i j k l m n (2 pts)
8. a b c d e f g h i j k l m n (2 pts)
9. a b c d e f g h i j k l m n (2 pts)
10. a b c d e f g h i j k l m n (2 pts)
11. a b c d e (5 pts)
12. a b c d e (5 pts)
13. a b c d e (5 pts)
14. a b c d e (5 pts)
15. a b c d e (5 pts)
16. a b c d e (5 pts)
17. a b (5 pts)
18. a b c d e (5 pts)
19. a b c d e (5 pts)

Name _____ Section L0 _____ Student No. _____

20. Draw ASM diagram here (20 pts)



21. (15 pts)

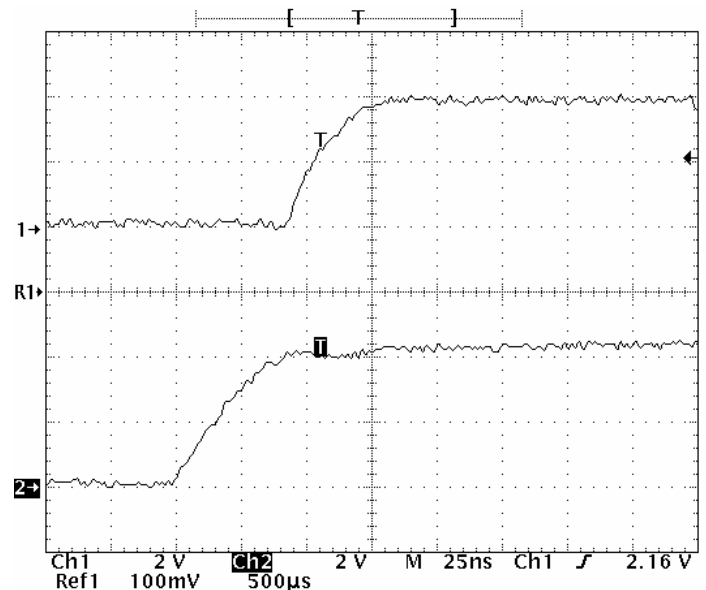
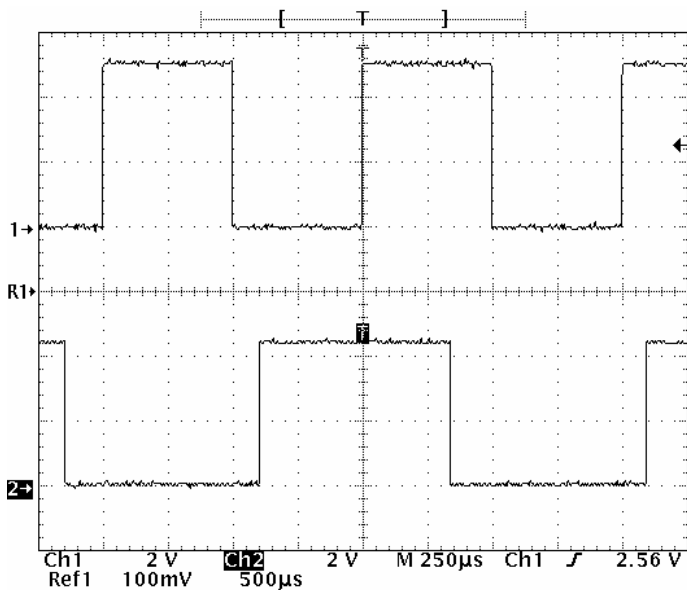
AB \ CD	00	01	11	10
00	0	0	1	0
01	0	1	1	0
11	0	1	1	1
10	1	1	0	0

Y =

**Closed Books, Closed Notes, No computers or calculators.
Mark all answers on the answer sheet.**

Questions 1-10: (20 points) Match the following Quartus informational, error, or warning messages to a likely cause by choosing a letter for each numbered item. There are extra options that are not correct answers, so be careful to pick the one best answer in each case, because no option can be used more than once.

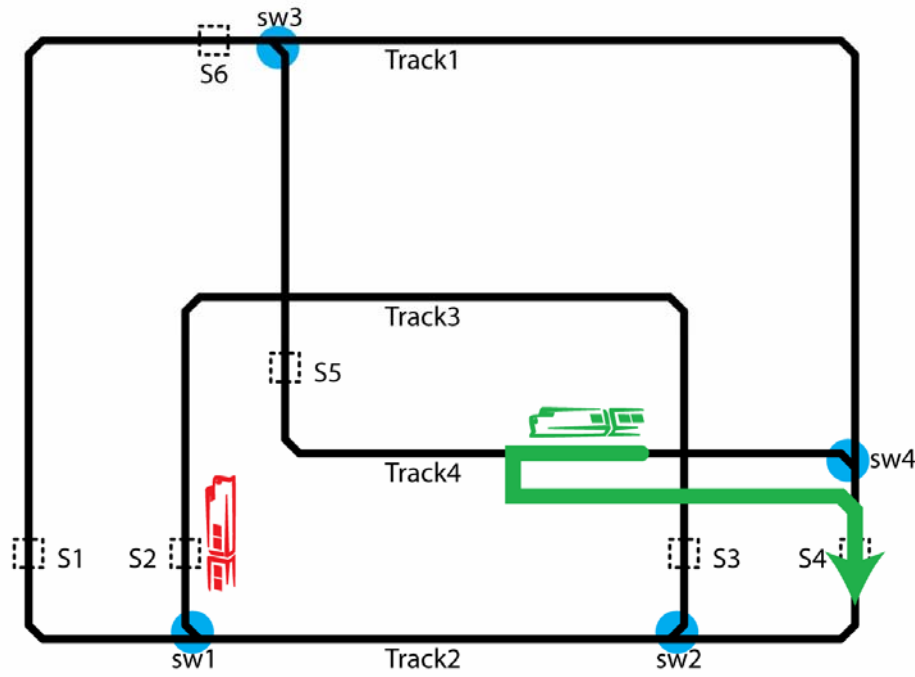
1. Assignment already exists for this assignment. Replacing existing assignment value with new assignment value
 2. Automatically selected device <name> for design <name>
 3. Block or symbol "<name>" of instance "<name>" overlaps another block or symbol
 4. Can't access JTAG chain
 5. Can't close project while a process is in progress
 6. Can't find Memory Initialization File or Hexadecimal (Intel-Format) File <name> -
- setting all initial values to 0
 7. Can't open project -- can't find file "<name>"
 8. Can't start device configuration because no programming options have been selected for device chain
 9. No simulation input file assignment specified on Simulator page of the Settings dialog box
 10. Output pins are stuck at VCC or GND
- a) One of the files listed as part of your project is missing
 - b) Quartus has communicated with the UP3 board and found some pins unexpectedly connected to power or ground
 - c) The "init_file=" parameter of a GENERIC MAP for an altsyncram device specifies a non-existing file
 - d) You are pressing buttons on the UP3 board while trying to close a project
 - e) You are using the Programmer tool and have not placed a checkmark beside any file listed in the Programmer window
 - f) You chose "Save As" under "File" and gave the name of an existing file.
 - g) You did not create a vector waveform file
 - h) You have defined signals that (perhaps deliberately) never change
 - i) You have not turned on the UP3 board
 - j) You just changed a pin number
 - k) You named a bus with an invalid name, and Quartus chose a different name
 - l) You need to clean up the placement of devices in a schematic
 - m) You started a compilation, but had not previously specified a particular target FPGA
 - n) You tried to quit Quartus before a compilation finished



11. (5 points) In the LEFT image, what is the period of the signal on the top?
 - a) About 250 μs
 - b) About 500 μs
 - c) About 1 ms
 - d) About 100 mV
 - e) None of the above are within $\pm 5\%$ of the correct value
12. (5 points) In the LEFT image, what is the duty cycle of the signal on the bottom?
 - a) About 25%
 - b) About 50%
 - c) About 250 μs
 - d) About 500 μs
 - e) None of the above are within $\pm 5\%$ of the correct value
13. (5 points) In the RIGHT image above, what is the rise time of the signal on channel 2?
 - a) About 35 ns
 - b) About 25 ns
 - c) About 500 μs
 - d) About 2.16 V
 - e) Unknown, since it is impossible to tell which signal is on channel 2.
14. (5 points) In the RIGHT image above, what is the propagation delay from the first rising edge to the second rising edge?
 - a) About 35 ns
 - b) About 25 ns
 - c) About 500 μs
 - d) Impossible to say, since the two signals have different vertical scales
 - e) Impossible to say, since the two signals have different time bases

15. (5 points) Look at the oscilloscope traces on the right (on the top of the previous page) one more time. You may be able to tell how the scope was triggered to get this capture, but ignore the EXACT method used here, and indicate which of the following would have resulted in a usable capture showing the two rising edges. (Select ALL that would have produced a capture suitable for the propagation delay measurement, assuming that other scope settings like position, vertical scale, horizontal scale, etc. were correct.)

- a) Set trigger level to about 2.5 V, rising edge, triggering on Channel 1
- b) Set trigger level to about 2.5 V, falling edge, triggering on Channel 1
- c) Set trigger level to about 2.5 V, rising edge, triggering on Channel 2
- d) Set trigger level to about 2.5 V, falling edge, triggering on Channel 2
- e) Set trigger level to about 5.0 V, rising edge, triggering on Channel 1



If Train A is between S4 and S5 when Train B arrives at S2, then Train A must go back to S4 while Train B waits.

16. (5 points) One of the slides from this semester's train problem is shown above. After Train A goes back to S4, what is it supposed to do next, according to the train assignment given?

- a) Continue traveling through Track 2 to S2
- b) Continue traveling through Track 2 to S1
- c) Wait at S4 until Train B clears Track 3
- d) Wait at S4 until Train B backs up onto Track 2
- e) None of the above

17. (5 points) Which of the following stances or gestures was recommended by Michael Laughter as being effective for presentations?

- a) The "fig leaf"
- b) The "weatherman"

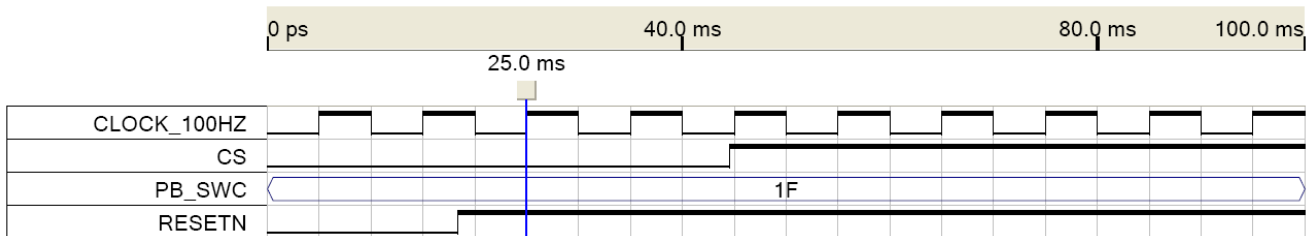
The VHDL code for PB_DIP is shown below. Questions 18 and 19 refer to this.

```

ENTITY PB_DIP IS
  PORT(
    CLOCK_100HZ : IN    STD_LOGIC;
    RESETN      : IN    STD_LOGIC;
    CS          : IN    STD_LOGIC;
    PB_SWC      : IN    STD_LOGIC_VECTOR( 7 DOWNTO 0 );
    IO_DATA     : INOUT STD_LOGIC_VECTOR(15 DOWNTO 0 )
  );
END PB_DIP;
ARCHITECTURE a OF PB_DIP IS
  SIGNAL BPB_SWC : STD_LOGIC_VECTOR(7 DOWNTO 0 );
BEGIN
  IO_BUS: lpm_bustri
  GENERIC MAP ( lpm_width => 16 )
  PORT MAP (
    data      => (x"00" & BPB_SWC),
    enabledt => CS,
    tridata  => IO_DATA
  );
  PROCESS (CLOCK_100HZ, RESETN)
  BEGIN
    IF (RESETN = '0') THEN
      BPB_SWC <= x"00";
    ELSIF (FALLING_EDGE(CLOCK_100HZ)) THEN
      BPB_SWC <= NOT(PB_SWC);
    END IF;
  END PROCESS;
END a;

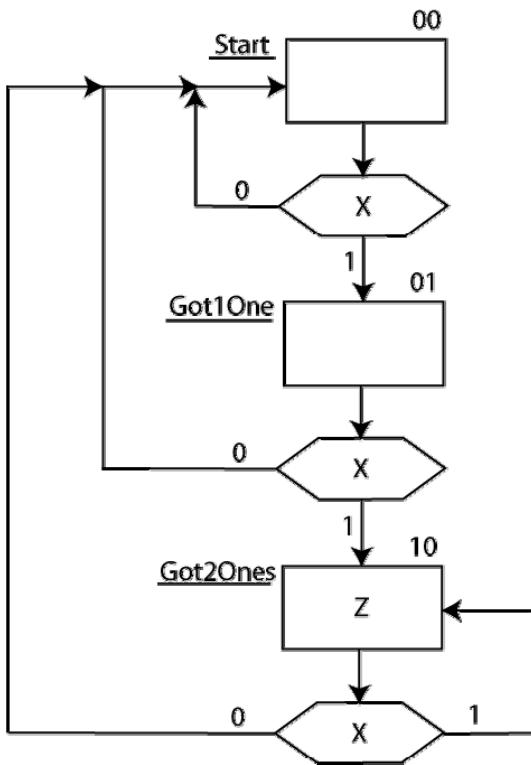
```

Also consider the simulation input waveforms shown below. You may assume that the timing characteristics (propagation delays, setup times) are very small (<10 ns), compared to the timescale you are viewing here.



18. (5 points) What would be the value of the internal signal BPB_SWC[0] at t=25.0 ms (where the vertical cursor is shown)?
- Unknown, uncertain, or uninitialized
 - 0
 - 1
 - 0x1F (1F hexadecimal)
 - None of the above

19. (5 points) What would be the value of IO_DATA at t=57 ms? (all numbers given as hexadecimal)
- High impedance (ZZZZ)
 - 0000
 - 00E0
 - 001F
 - FFE0



20. (20 points) The ASM diagram above is the one from the lab manual and slides, showing a state machine with one input X, and one output Z, where the output is asserted if and only if the two most recent values of X have been 1.
- Using this same concept of a sequence-detecting state machine, draw the ASM diagram for a state machine that asserts its output Z if and only if the two most recent values of X have been 0, followed by 1. There is no need to number the states, but you must name them, you must indicate the Start state, and you must show what happens for every possible value of the input X. For full credit, use the minimum number of states.
21. (15 points) Solve the Karnaugh map on the answer sheet, producing a minimal sum of products expression, by
- Circling the correct, minimal set of prime implicants on the diagram (10 points)
 - Writing the reduced expression where indicated below the diagram (5 points)