

Instructions:

- ☀ For multiple choice questions, circle the letter of the one best choice unless the question explicitly states that it might have multiple correct answers.
- ☀ There is no penalty for guessing.
- ☀ Place drawings where indicated in the question; be sure to put the question number next to your drawing; use pencil rather than ink.
- ☀ No electronic devices allowed.

1. Did you read the instructions? _____
2. Are you allowed to use any electronic devices during this exam? _____
3. (2 points) A signal has a frequency of 2KHz. What is its period?
 - A. 2,000
 - B. 2×10^3
 - C. 2 sec
 - D. 0.002 sec
 - E. 500 μ sec
4. (2 points) A signal has a period of 20 nsec. What is its frequency?
 - A. 20 GHz
 - B. 50 GHz
 - C. 20 MHz
 - D. 50 MHz
 - E. 20 nsec
5. (2 points) 25,000 is how many orders of magnitude larger than 25?
 - A. 25
 - B. 1,000
 - C. 400
 - D. 3
 - E. 2.5
6. (2 points) Convert 500 nanoseconds to picoseconds.
 - A. 5,000
 - B. 500,000
 - C. 0.500
 - D. 0.005
 - E. 5,000,000
7. (2 points) How much larger than a gram is a kilogram?
 - A. 3 orders of magnitude larger
 - B. 10^3 times larger
 - C. 1,000 times larger
 - D. 100,000% larger
 - E. All of the above

8. (2 points) What unit of measure would be used to represent a value between 1 and 999 thousandths of a second as an integer value between 1 and 999?
- A. milliseconds
 - B. microseconds
 - C. millihertz
 - D. megahertz
 - E. microhertz
9. (5 points) Calculate the weighted average of the following values; show all work.

Value	Frequency
10	20
20	70
30	10

Answer: _____

10. (2 points) How many bits in a byte? _____
11. (5 points) How many bits in a gigabyte? (Answer using powers of two.) _____
12. (5 points) A disk spins at 6,000 RPM. How long does it take to make one revolution? Show all work.

Answer: _____

13. (5 points) Computer A takes 5 seconds to perform a calculation. Computer B takes 7.5 seconds to perform the same calculation. Complete this sentence that tells which computer is faster and by what ratio.

“Computer ____ is ____ times faster than computer ____.”

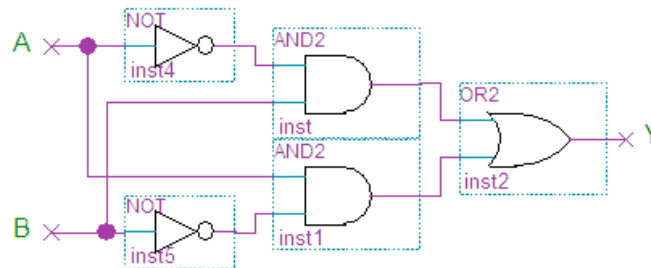
14. (5 points) Rewrite your answer to the previous question as a percentage.

“Computer ____ is ____ % faster than computer ____.”

15. (5 points) How long would it take to upload a 1 GB file over a 20 MBps network link? Show all work. Be sure to indicate the unit of measure for your answer.

Answer: _____

16. (2 points) What is the term that tells how long it takes a logic network to produce a new result after the inputs change?
- A. state transition time
 - B. clock interval
 - C. clock frequency
 - D. propagation delay
 - E. power dissipation
17. (5 points) How long would it take this logic network to produce a new result after the inputs change?

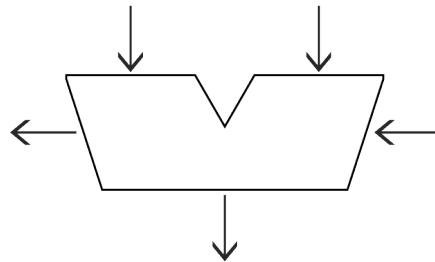


Answer: _____

18. (2 points) If the network in Question 17 were to be used as a Quartus module, what devices would have to replace the little x's next to A, B, and Y?
- A. Two switches and a LED
 - B. Two LEDs and a switch
 - C. Two input pins and one output pin
 - D. Two connections to ground and one connection to Vcc
 - E. Three big X's
19. (5 points) Write a boolean equation for the function implemented by the network in Question 17. (Do not try to minimize the function.)

Answer: $Y = \underline{\hspace{2cm}}$

20. (5 points) Draw a logic network that implements a 2×4 decoder using only AND, OR, and NOT gates. Put your diagram on the back of an exam sheet. Be sure to put the question number (20) next to it.
21. (5 points) Write the truth table for a full adder on the back of an exam sheet. Be sure to put this question number (21) next to your answer.
22. (5 points) Draw a logic network that implements a 2×1 multiplexer using only AND, OR, and NOT gates. Put your diagram on the back of an exam sheet. Be sure to put the question number (22) next to your answer. *Note: this is not the same as the 4×1 multiplexer you built for Assignment 2; adjust your answer accordingly!*
23. (5 points) Label the inputs and outputs of this ALU symbol for the 32-bit MIPS ALU developed in the textbook. Show the number of wires for each input and output. Answer here:



24. (5 points) What is the difference between a Node Line and a Bus Line in Quartus?
25. (8 points) On the back of an exam sheet draw the schematic for one slice of the MIPS ALU developed in the textbook, but do include the SLT_{out} output used in Assignment 3. Use symbols for any multiplexers and/or full-adders in your diagram; for everything else, draw the gates. Be sure to label all inputs and outputs accurately. If you need to write the question number next to your diagram so I'll recognize it, you're in trouble.

26. (8 points) For the four-bit ALU implemented in Assignment 3, fill in the right two columns in hexadecimal.

Row	A	B	Function	CVNZ	Result
I	0	0	0		
II	3	D	6		
III	5	6	2		
IV	1	F	7		

27. (2 points) Explain what is happening in the ALU for Row I of Question 26.

28. (2 points) Explain what is happening in the ALU for Row III of Question 26.