Digital Electronics™
Final Examination

Part A

Spring 2007

Student Name: _____

Date: _____

Class Period: _____

Total Points: _____ / 40

Converted Score**:** _____ / 50

Multiple Choice

Directions: **Select the letter of the response which best completes the item or answers the question. Then fill in the separate *Part A Answer Sheet*.**

1. This task should be done before connecting an LED to a circuit.

    A. Place the LED directly across the power supply to see if the LED has not been damaged.

    C. Use Ohm's Law to calculate the appropriate current limiting resister to place in series with the LED.

    B. Place a capacitor in series with the LED to limit the maximum amount of current.

    D. Use Ohm's Law to calculate the appropriate current limiting resister to place in parallel with the LED.

2. Using scientific notation, which prefixes are used for values larger than a whole number?

    A. Milli, Micro, Kilo

    C. Nano, Pico, Giga

    B. Mega, Kilo, Giga

    D. Milli, Nano, Mega

3. What is the value of the resistor shown below?

    Silver
    Brown
    Blue
    Orange

    A. 160 K Ω ±10 %

    C. 360 Ω ±10 %

    B. 360 Ω ±5 %
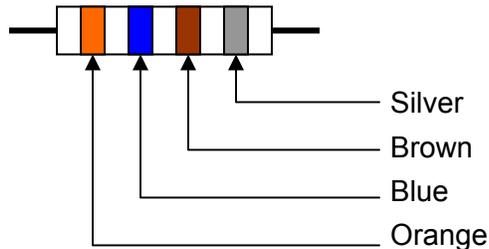
    D. 36 K Ω ±5 %

4. What are the color bands for a 56 K Ω (±5) resistor?

    A. YELLOW-GREEN-RED-SILVER

    C. BLUE-GRAY-GREEN-GOLD

    B. GREEN-BLUE-ORANGE-GOLD

    D. GREEN-BLUE-ORANGE-SILVER

5. In a parallel circuit, you measure 20 mVolts across a 400 Ω resistor. How much current is flowing through the resistor?

  A. 8 Amps   *C.* 500 mAmps

  B. 5 mAmps   *D.* 50 μAmps

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6. Which of the waveforms shown below would be described as an analog triangle wave?
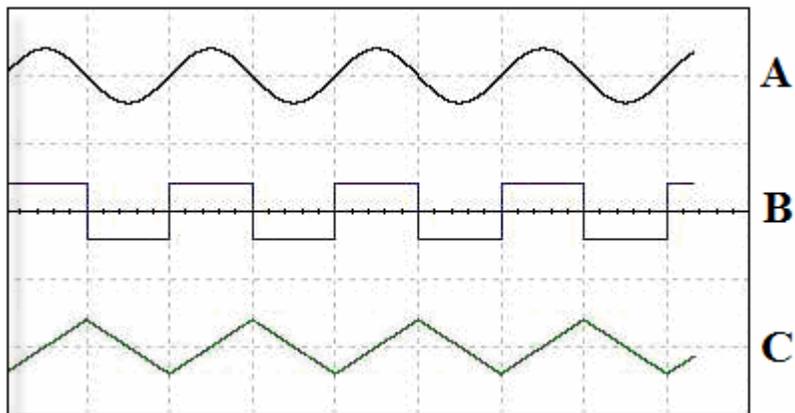
  A. Waveform A   *C.* Waveform C

  B. Waveform B   *D.* None of the above

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7. What is the binary equivalent to the decimal number 13_{10}?
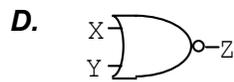
  A. 1101_2 *C.* 1011_2

  B. 0111_2 *D.* 1001_2
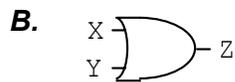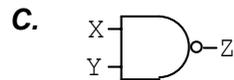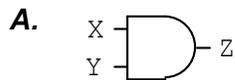
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8. What is the hexadecimal equivalent to the binary number 1010_2?

  A. 5_H *C.* 10_H

  B. A_H *D.* 2_H

---

9. The truth-table shown below represents which of the following gates?

X	Y	Z
0	0	0
0	1	1
1	0	1
1	1	1

A.

X
Y ⟩– Z

C.

X
Y ⟩o–Z

B.

X
Y ⟩– Z

D.

X
Y ⟩o–Z

---

10. The truth-table shown below represents which of the following gates?

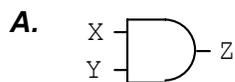| X	Y	Z
0	0	1
0	1	1
1	0	1
1	1	0

A.

X
Y ⟩– Z

C.

X
Y ⟩o–Z

B.

X
Y ⟩– Z

D.

X
Y ⟩o–Z
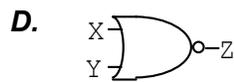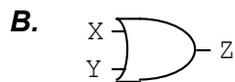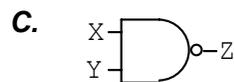
11. The gate shown below is represented by which of the following truth-tables?

X ─┐
)o─Z
Y ─┘

A.

X	Y	Z
0	0	0
0	1	0
1	0	0
1	1	1

C.

X	Y	Z
0	0	0
0	1	1
1	0	1
1	1	1

B.

X	Y	Z
0	0	1
0	1	1
1	0	1
1	1	0

D.

X	Y	Z
0	0	1
0	1	0
1	0	0
1	1	0

---

12. The gate shown below is represented by which of the following truth-tables?

X ─┐
   D─ Z
Y ─┘

A.

X	Y	Z
0	0	0
0	1	0
1	0	0
1	1	1

C.

X	Y	Z
0	0	0
0	1	1
1	0	1
1	1	1

B.

X	Y	Z
0	0	1
0	1	1
1	0	1
1	1	0

D.
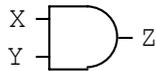
X	Y	Z
0	0	1
0	1	0
1	0	0
1	1	0

---

13. Which of the following is a rule of Boolean algebra?

A. $X \cdot \overline{X} = \overline{X}$

C. $X + \overline{X} = 0$

B. $X \cdot X = X$

D. $X + X = 1$

14. Which of the following is an example of Distributive Law of Boolean algebra?

    A. $X(YZ)=(XY)Z$ *C.* $XY = YX$

    B. $X+XY = X$ *D.* $X(Y+Z)=XY+XZ$

---

15. Which of the following is the simplified equivalent for the Boolean equation shown?

$$F_{15} = XY + X\overline{Y}$$

    A. $F_{15} = XY$ *C.* $F_{15} = X\overline{Y}$

    B. $F_{15} = X$ *D.* $F_{15} = Y$

---

16. Which of the following equations is the *un-simplified* Sum-Of-Products equation for the truth table shown?

X	Y	Z	F_{16}
0	0	0	0
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	0

    A. $F_{16} = \overline{X}\,\overline{Y}Z + \overline{X}Y\overline{Z} + XY\overline{Z}$

    C. $F_{16} = \overline{X}\,\overline{Y}Z + \overline{X}\,\overline{Y}Z + XY\overline{Z}$

    B. $F_{16} = \overline{X}\,\overline{Y}Z + \overline{X}Y\,\overline{Z} + X\overline{Y}Z$

    D. $F_{16} = X\overline{Y}\,\overline{Z} + \overline{X}Y\,\overline{Z} + XY\overline{Z}$

17. Which of the following un-simplified Boolean expressions represent the logic circuit shown below?
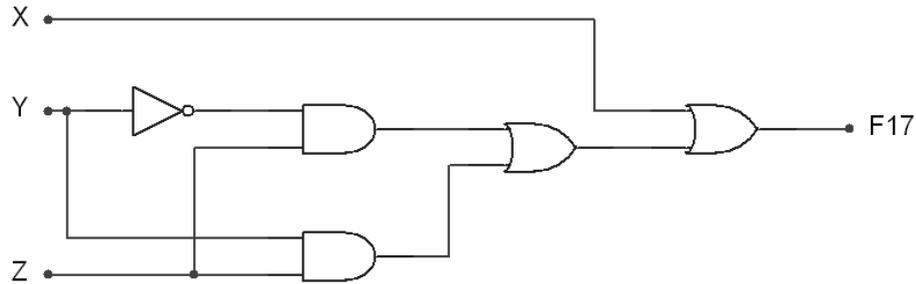
A. $F_{17} = X + \overline{Y} Z + \overline{Y}\,\overline{Z}$

B. $F_{17} = X + \overline{Y} Z + Y Z$

C. $F_{17} = X + Y \overline{Z} + Y Z$

D. $F_{17} = \overline{X} + \overline{Y} Z + Y Z$

18. Which of the following is a correct DeMorgan's Identity?

A. $\overline{X Y} = \overline{X} \bullet \overline{Y}$

B. $\overline{X Y} = X \bullet Y$

C. $\overline{X Y} = \overline{X} + \overline{Y}$

D. $\overline{X Y} = X + Y$

19. Which of the following is the simplified equivalent for the Boolean equation shown?

$$F_{19} = \overline{\overline{X}\,\overline{Y}}$$

A. $F_{19} = \overline{X} Y$

B. $F_{19} = X + \overline{Y}$

C. $F_{19} = X \overline{Y}$

D. $F_{19} = \overline{X} + Y$

W	X	Y	Z	F_{20}
0	0	0	0	0
0	0	0	1	0
0	0	1	0	1
0	0	1	1	1
0	1	0	0	0
0	1	0	1	1
0	1	1	0	1
0	1	1	1	0
1	0	0	0	1
1	0	0	1	1
1	0	1	0	0
1	0	1	1	0
1	1	0	0	0
1	1	0	1	0
1	1	1	0	0
1	1	1	1	1

A.

	$\overline{W}\,\overline{X}$	$\overline{W}\,X$	$W\,X$	$W\,\overline{X}$
$\overline{Y}\,\overline{Z}$	0	0	1	1
$\overline{Y}\,Z$	0	1	0	1
$Y\,Z$	1	1	0	0
$Y\,\overline{Z}$	0	0	1	0

C.

	$\overline{W}\,\overline{X}$	$\overline{W}\,X$	$W\,X$	$W\,\overline{X}$
$\overline{Y}\,\overline{Z}$	0	0	1	0
$\overline{Y}\,Z$	0	1	1	0
$Y\,Z$	1	0	0	1
$Y\,\overline{Z}$	1	1	0	0

B.

	$\overline{W}\,\overline{X}$	$\overline{W}\,X$	$W\,X$	$W\,\overline{X}$
$\overline{Y}\,\overline{Z}$	0	0	0	1
$\overline{Y}\,Z$	0	1	0	1
$Y\,Z$	1	1	0	0
$Y\,\overline{Z}$	1	0	1	0

D.

	$\overline{W}\,\overline{X}$	$\overline{W}\,X$	$W\,X$	$W\,\overline{X}$
$\overline{Y}\,\overline{Z}$	0	0	0	1
$\overline{Y}\,Z$	0	1	0	1
$Y\,Z$	1	0	1	0
$Y\,\overline{Z}$	1	1	0	0

21. Which of the following logic circuits correctly implements the Boolean equation?

$$F_{21} = \overline{Y} Z + Y \overline{Z}$$

A.   F21   **C.**   F21

B.   F21   **D.**   F21
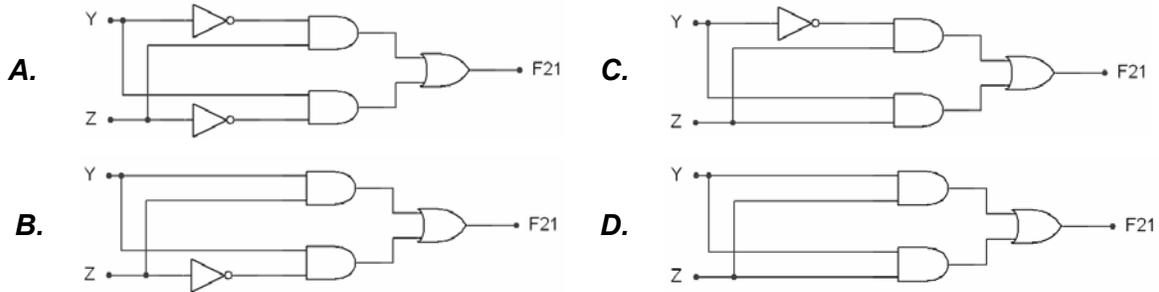
22. Which of the following K-maps is grouped properly and will result in the simplest solution?

A.

	$\overline{X}\,\overline{Y}$	$\overline{X}\,Y$	$X\,Y$	$X\,\overline{Y}$
$\overline{Z}$	1	0	X	0
Z	1	X	X	1

C.

	$\overline{X}\,\overline{Y}$	$\overline{X}\,Y$	$X\,Y$	$X\,\overline{Y}$
$\overline{Z}$	1	0	X	0
Z	1	X	X	1

B.

	$\overline{X}\,\overline{Y}$	$\overline{X}\,Y$	$X\,Y$	$X\,\overline{Y}$
$\overline{Z}$	1	0	X	0
Z	1	X	X	1

D.

	$\overline{X}\,\overline{Y}$	$\overline{X}\,Y$	$X\,Y$	$X\,\overline{Y}$
$\overline{Z}$	1	0	X	0
Z	1	X	X	1

23. Which Boolean equation is in Product-Of-Sums form?

A. $F_{23} = X\,Y\,\overline{Z} + X\,\overline{Y} + X\,Y\,Z$

C. $F_{23} = (X + Y)(X + Z)(\overline{Y} + Z)$

B. $F_{23} = X\,\overline{Y}\,\overline{Z} + Z\,(X + Y)$

D. $F_{23} = X\,(Y + Z)(\overline{Y} + Z)$

24. The three circuits shown below all implement the logic equation:
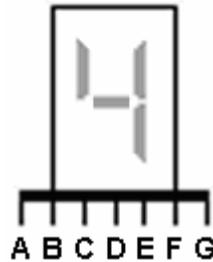
$$F_{24} = \overline{X} + \overline{Y}\,Z$$

Of these circuits, which one would require the least number of IC chips?

A.

C.

B.
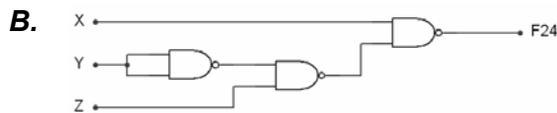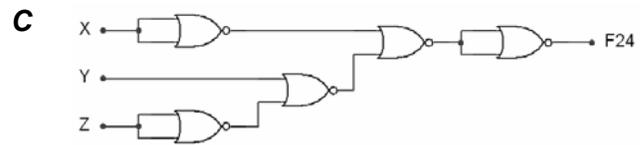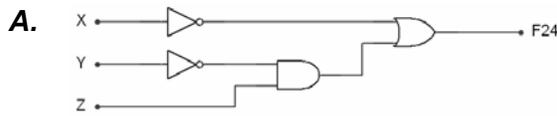
D. All of the above

25. What logic values need to be placed on the inputs (a) through (g) of the common-cathode seven-segment in order to display the number 4?

A B C D E F G

A.

A	B	C	D	E	F	G
1	0	0	1	1	0	1

C.

A	B	C	D	E	F	G
0	1	1	0	0	1	1

B.

A	B	C	D	E	F	G
0	1	0	0	1	1	0

D.

A	B	C	D	E	F	G
0	0	1	1	1	0	1

26. When typing the Boolean expression $F = \overline{X} + \overline{Y}\,Z$ into the WinCupl program, which of the following expressions would be entered?

A. $F = !X \,\#\, !Y \,\&\, Z;$

C. $F = not(X)\ or\ not(Y)\ and\ Z;$

B. $F = !X + !Y\,Z;$

D. $F = X' + Y'Z;$

27. The gate shown below is represented by which of the following truth-tables?
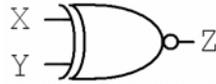
A.

X	Y	Z
0	0	1
0	1	0
1	0	0
1	1	1

C.

X	Y	Z
0	0	1
0	1	0
1	0	1
1	1	0

B.

X	Y	Z
0	0	0
0	1	1
1	0	1
1	1	0

D.

X	Y	Z
0	0	0
0	1	1
1	0	0
1	1	1

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28. Which of the following circuits is a half-adder?

A.

C.

B.

D.

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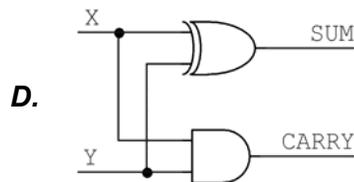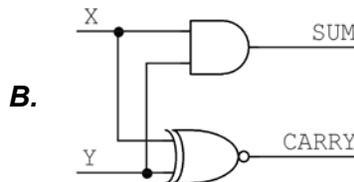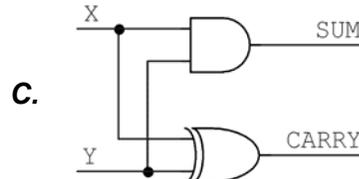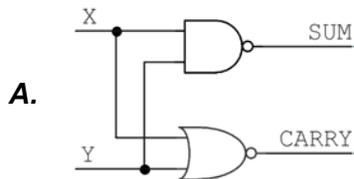
29. How are the Q and $\overline{Q}$ outputs of a flip flop affected by setting the active high *asynchronous* PRESET input to a logic one?

A. No change.

C. $Q=0$ and $\overline{Q}=1$

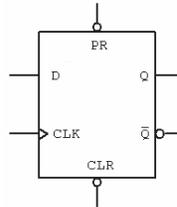B. $Q=1$ and $\overline{Q}=0$

D. $Q=1$ and $\overline{Q}=1$

30. Which of the devices shown below is a Negative Edge Triggered J/K Flip-Flop?

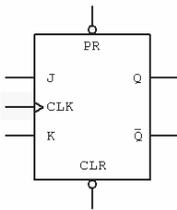**A.**
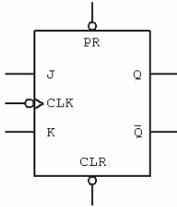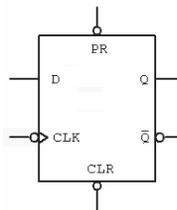

C.

B.

D.

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31. How many flip-flops are required to implement a divide-by-8 circuit?

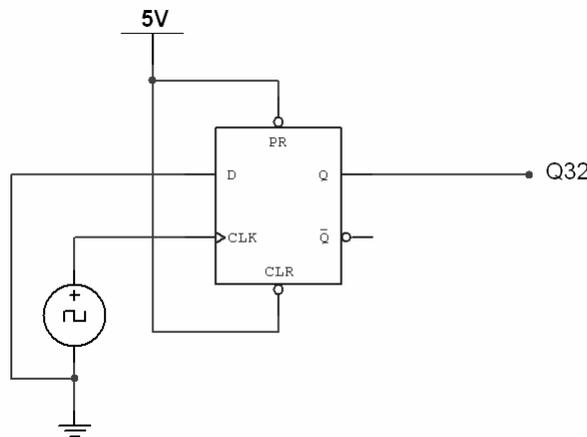**A.** 1   **C.** 3

B. 2   **D.** 4

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32. Regardless of its current value, what will happen to the output **Q32** on the next clock pulse?
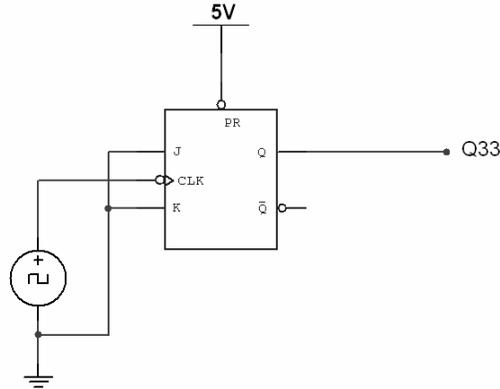

A. Q32 will be low.   **C.** Q32 will toggle.

B. Q32 will be high.   **D.** Q32 will not change.
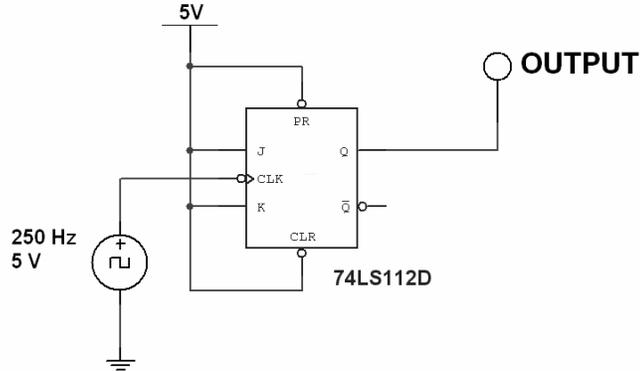
33. Regardless of its current value, what will happen to the output **Q33** on the next clock pulse?

A. Q33 will be low.	**C.** Q33 will toggle.
B. Q33 will be high.	**D.** Q33 will not change.

34. Determine the frequency of the signal **OUTPUT** for the circuit shown below.

A. 250 Hz.	**C.** 500 Hz.
B. 125 Hz.	**D.** 1 KHz.

35. What type of shift register is shown below?

Q0   **Q1**   **Q2**   **Q3**
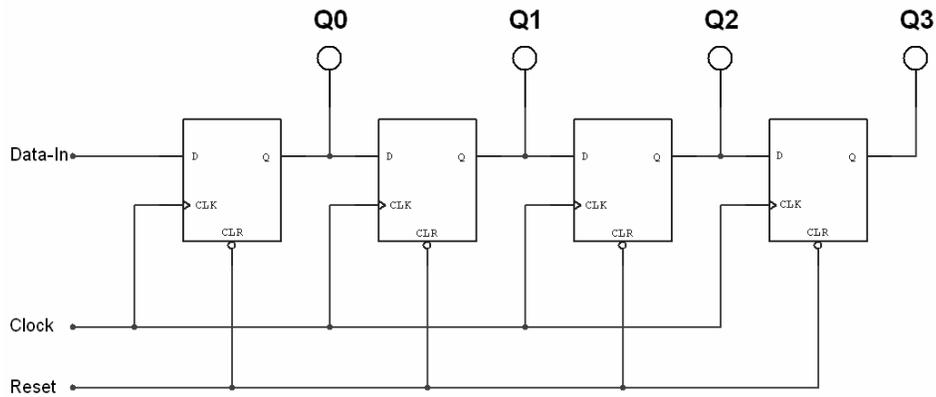
A. Serial-In / Serial-Out	*C.* Parallel-In / Parallel-Out
B. Serial-In / Parallel-Out	*D.* Parallel-In / Serial-Out

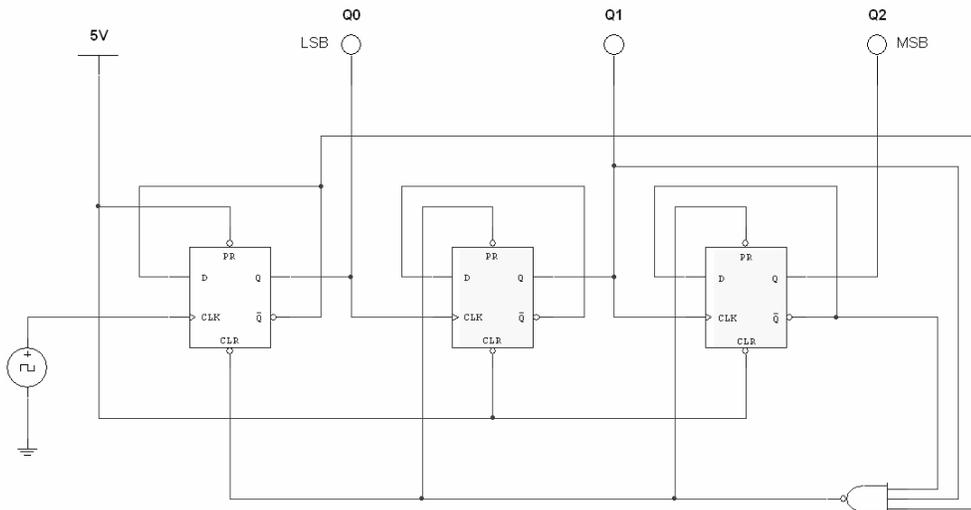36. Asynchronous counters are also called _____.

A. glitch counters.	*C.* ripple counters.
B. pulse wave counters.	*D.* step counters.

37. What is the count range of the 3-bit asynchronous shown below?

A. 2 to 6	*C.* 6 down to 2
B. 3 to 6	*D.* 6 down to 3

38. What is the count range of the 4-bit synchronous shown below?
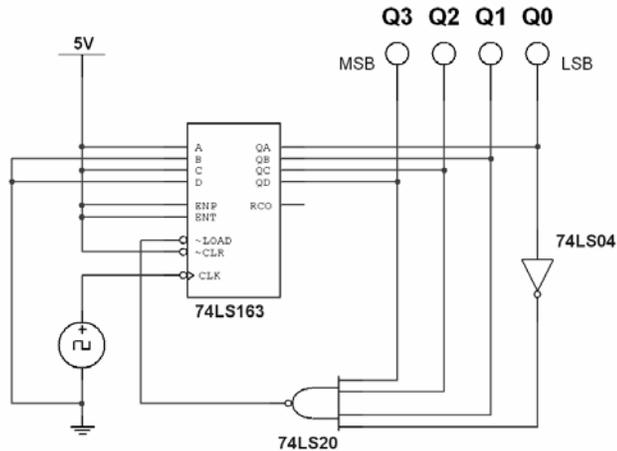
A. 5 to 14   C. 4 to 14

B. 5 to 15   D. 4 to 15

39. When comparing TTL logic gates to CMOS gates, which of the following statements is true?

A. TTL gates use <u>less</u> power than CMOS gates.

C. TTL are <u>faster</u> than CMOS gates.

B. TTL have a <u>higher</u> noise margin than CMOS gates.

D. TTL gates are <u>more</u> sensitive to static electricity than CMOS gates.

40. Propagation delay is _____.

A. a measure of the ability of a logic gate to drive further logic gates.

C. the difference between what a logic gate outputs as a valid logic voltage and what the input of the next gates expects to see as a valid logic voltage.

B. the difference in chip temperature from when the power is off to when the power is on.

D. the time required for a signal to travel from the input of a logic gate to the output.