

Ag & Bio Engr Dept  
ISU

100 1  
900 1  
800 13  
700 11  
600 5 awl 81  
500 8  
400 4  
300 1  
44

4/5/07  
CJB

Name

KEY

TSM 363 Exam 3

Open: one 8.5x11 page both sides  
Multiple choice: 2 pts each

- 1) To use a thermostat to control a cooling fan, connect to
  - a) common and close-on-rise.
  - b) common and close-on-fall.
  - c) close-on-rise and close-on-fall.
  - d) (a) or (b) depending on what temperature you are working at.
  
- 2) The active element in a humidistat is
  - a) a microswitch
  - b) a strip of nylon
  - c) a metal diaphragm
  - d) a fluid - filled bellows
  
- 3) Common relay coils require about this much current to trip:
  - a) .005 amp
  - b) .05 amp
  - c) .5 amp
  - d) 5 amps
  
- 4) With the actuating pin depressed on a micro switch, there is a complete circuit from:
  - a) NO to C
  - b) NC to C
  - c) NO to NC
  - d) C to NO and NC
  
- 5) An electric motor is controlled by a start-stop station through a magnetic motor starter. When the stop button is pushed, the motor stops, but re-starts when the button is released. Probable cause:
  - a) an overload switch stuck open.
  - b) coil short-circuited.
  - c) auxiliary contacts stuck closed.
  - d) auxiliary contacts stuck open.
  - e) none of the above
  
- 6) A magnetic motor starter with a start-stop station will start the load when START is pushed, but stops when START is released. Probable cause:
  - a) START stuck closed.
  - b) auxiliary contacts stuck closed.

- c) auxiliary contacts stuck open.
- d) coil short-circuited.
- e) none of the above

7) Magnetic motor starters for single and three-phase motors come with this number of load poles:

- a) 1
- b) 2
- c) 3
- d) 4
- e) 5

8)  $\overline{AB} =$

$$\overline{A+B}$$

- a) BA
- b)  $\overline{B+A}$
- c)  $\overline{AB}$
- d)  $\overline{A+B}$
- e) none of the above

9)  $A0 =$

- a) 0
- b) 1
- c) A
- d) none of the above

10)  $A\overline{A} =$

$$\begin{array}{ccc} A & \overline{A} & A\overline{A} \\ 0 & 1 & 0 \\ 1 & 0 & 0 \end{array}$$

- a) 0
- b)  $\frac{1}{A}$
- c)  $\overline{A}$
- d) A
- e) none of the above

11)  $\overline{A+B} =$

$$\overline{AB} = \overline{A}\overline{B}$$

- a)  $\overline{A+B}$
- b)  $\overline{AB}$
- c)  $\overline{AB}$
- d)  $\overline{A+B}$
- e)  $\overline{AB}$
- f) none of the above

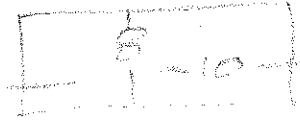
12) An oscilloscope can measure

- a) AC voltage
- b) DC voltage
- c) a and b

- 13) A solid-state relay
- a) has no moving parts
  - b) has load "contacts" that never really close
  - c) has load "contacts" that never really open
  - d) a,b,c

14) Assume an oscilloscope has an 8 division high by 10 division wide screen. If the seconds per division is set at 0.1 ms, the amount of time represented by the width of the screen is:

- a) 0.1 ms
- b) 0.8 ms
- c) 1 ms
- d) 1 s
- e) 0.1 kHz



$$.1 (10) = 1$$

15) (15) Does  $(A + B)(A + C)$  equal  $A + BC$  ? Prove your answer.

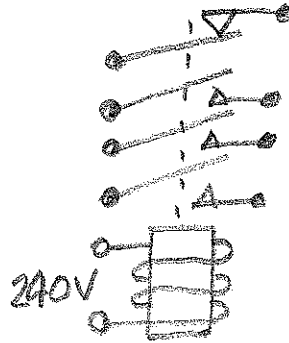
A	B	C	A+B	A+C	(X)	BC	A+BC
0	0	0	0	0	0	0	0
0	0	1	0	1	0	0	0
0	1	0	1	0	0	0	0
0	1	1	1	1	1	1	1
1	0	0	1	1	1	0	1
1	0	1	1	1	1	0	1
1	1	0	1	1	1	0	1
1	1	1	1	1	1	1	1

YES

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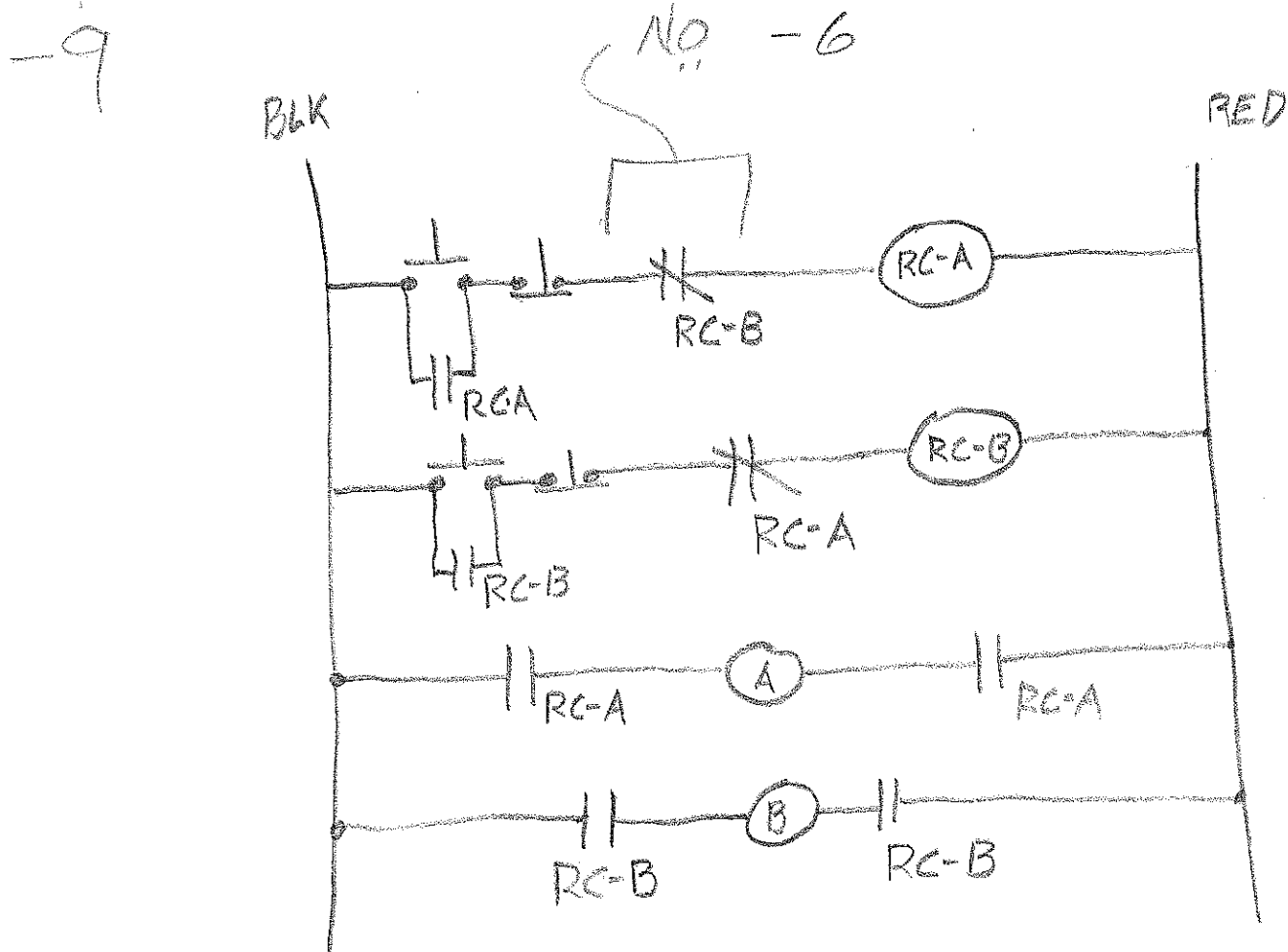
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16) (25) Two 240-V single-phase motors designated Motor A and Motor B are controlled by two relays like this:



Along with two push-button stations. The motors must be wired so that if A is started first, B cannot come on and if B is started first, A cannot come on. Draw a ladder diagram showing both the load and coil circuits. NOTE THAT THE RELAY COILS ARE 240 V.

-7 120V COIL



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17. (25) The ventilation fan for a poultry confinement building is controlled by three binary input switches:

A: A = 0 when temp is above 70 F  
 A = 1 when temp is at or below 70

A=0    A=1  
 B=0    B=0  
 C=0    C=0    C=1

B: B = 0 when electrical demand is high  
 B = 1 when electrical demand is low

C: C = 1 when wind is high  
 C = 0 when wind is low.

The fan should be on ( $Q_F = 1$ ) if temperature is high and wind is low, regardless of demand. The fan should be on when demand is high if wind is low and temperature is low, or when wind is high and temperature is high.

1. Write the truth table for  $Q_F$
2. Write the equation for  $Q_F$  and simplify it.
3. Draw a circuit that satisfies the simplified equation using inverters and 2-input gates.
4. Write the truth table for your circuit.

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A	B	C	$Q_F$
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	0

$$Q_F = \bar{A}\bar{B}\bar{C} + \bar{A}\bar{B}C + \bar{A}B\bar{C} + A\bar{B}\bar{C}$$

$$Q_F = \bar{A}\bar{B} + \bar{C}(\bar{A}B + A\bar{B})$$

