

Student Name: \_\_\_\_\_

ID: \_\_\_\_\_

Question #1

Given the following machine control sequence:

*Start,  $A^+$ , 10s delay,  $B^+$ , (repeat 4 times;  $(C^+, C^-)$ ),  $B^-$ , 20s delay,  $A^-$ .*

- (a) Re-arrange the machine sequence using on-delay and/or off-delay functions assume sustain control signal for cylinder *A* and non-sustain control signal for cylinder *B*.
- (b) Develop *RLL* for the automatic cycle of the given machine sequence.
- (c) Modify the machine *RLL* program developed in (b) to have *Auto/Man* cycle?
- (d) Sketch the controller panel showing all switches required for actuating the Auto and Manual cycles?  
Also, state type of switches used on the controller panel ?

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Question #2

- a) What is the main difference between sustain and non-sustain control signals for pneumatic directional control valves? Sketch two valves one has sustain and other has non-sustain control signals?
- b) Develop *RLL* for automatic cycle have analogue output (DA) as shown below, assume non-sustain control signals for cylinder *B* and *C* ?

Given , the equation used to convert from digital to analog  $D=200A$ , where A; analog signal and D; digital value. Furthermore, analog conversion register address is YW005

*Start, (DA 2.5Volts), B<sup>+</sup>, C<sup>+</sup>, 10s delay, B<sup>-</sup>, C<sup>-</sup>, (DA 0.0Volts).*

**King Saud University**  
College of Engineering  
Industrial Engineering Department  
Industrial Automation IE437      Exam #2      Time 45 Min

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