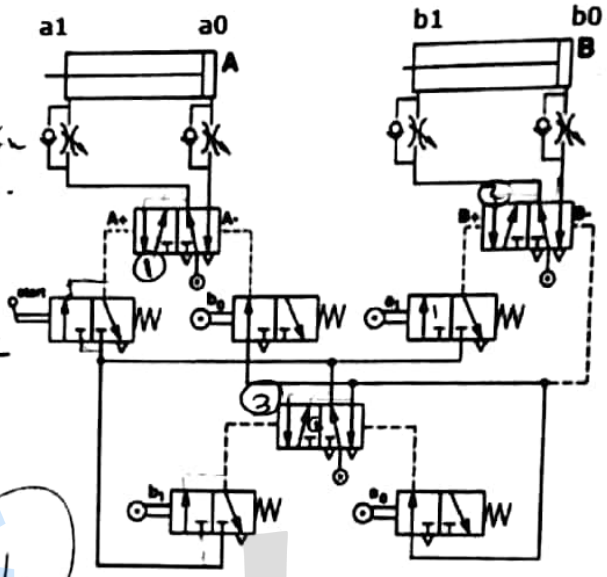
Question One (6pts)

Show work to get partial credit and write neatly.

1. Given the nearby Pneumatic circuit, answer the following questions
   a. What is the objective of this circuit
   b. In steps, discuss it's operation



a- , meter out Extension meter out Retraction for A & B (flow control).

b- A+B+B-A-

case	position	a_1	a_0	b_1	b_0
0					

[1] Start lever will be pressed & give apilot signal (A^+) to DCV ① then air flow will go through FCV (check valve) & Extend cylinder A, at the end of extension stroke limit switch A_1 will be activated, & the flow at the rod end of cyl. A will be meter out via FCV & go through Exhaust.

[2] Since A1 has been activated, position ① of ③ will be activated & air flow will go through the check valve of the FCV of cyl. B & then it will extend & limit switch b1 at the end of it's extension stroke will be activated & a meter out for the exhaust from the rod end of B.

[3] when B1 is activated it will give a pilot signal to DCV ③ at which position ① will be activated, then it will retract cyl. B by giving a pilot signal (B^-) to DCV ② & then activate a_0.

[4] when a_0 is activated it will give apilot signal to DCV ③ to change it's position to position 2 at will retract cylinder A.

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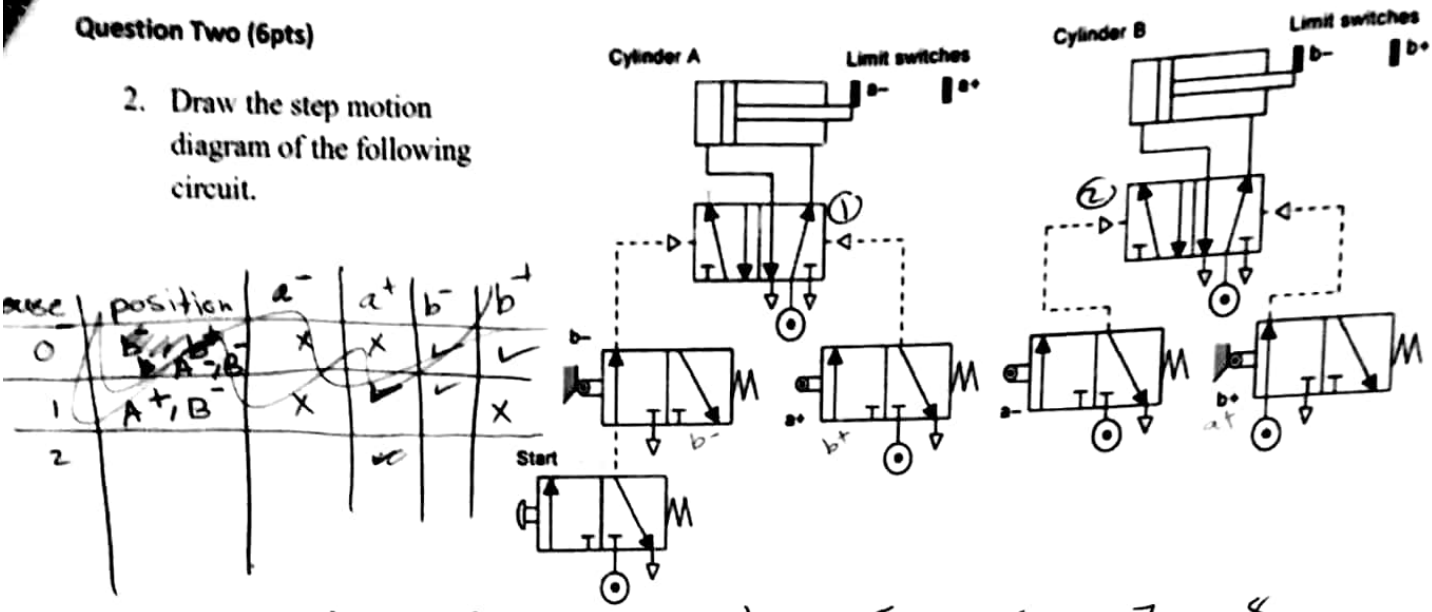
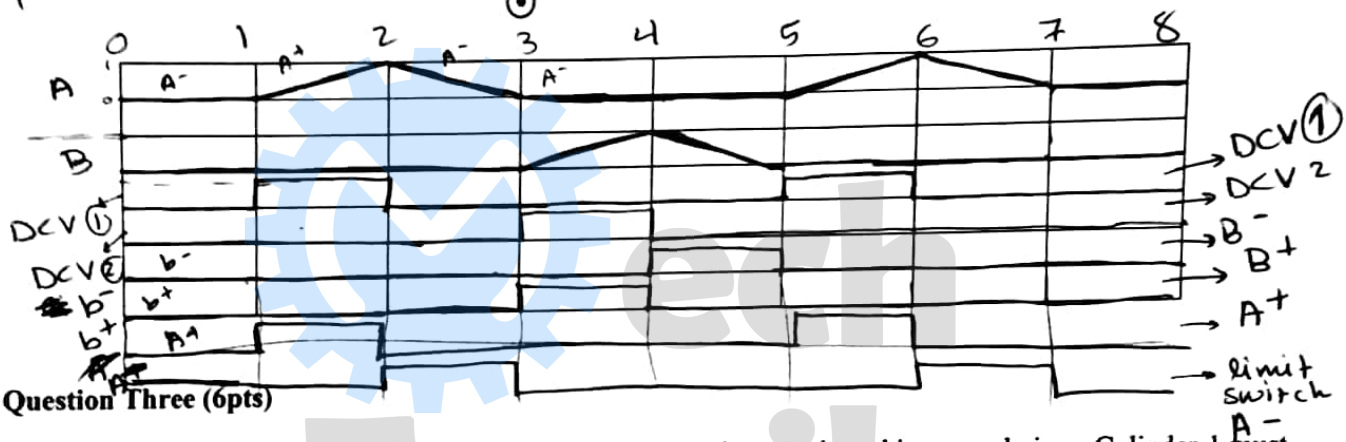
Question Two (6pts)

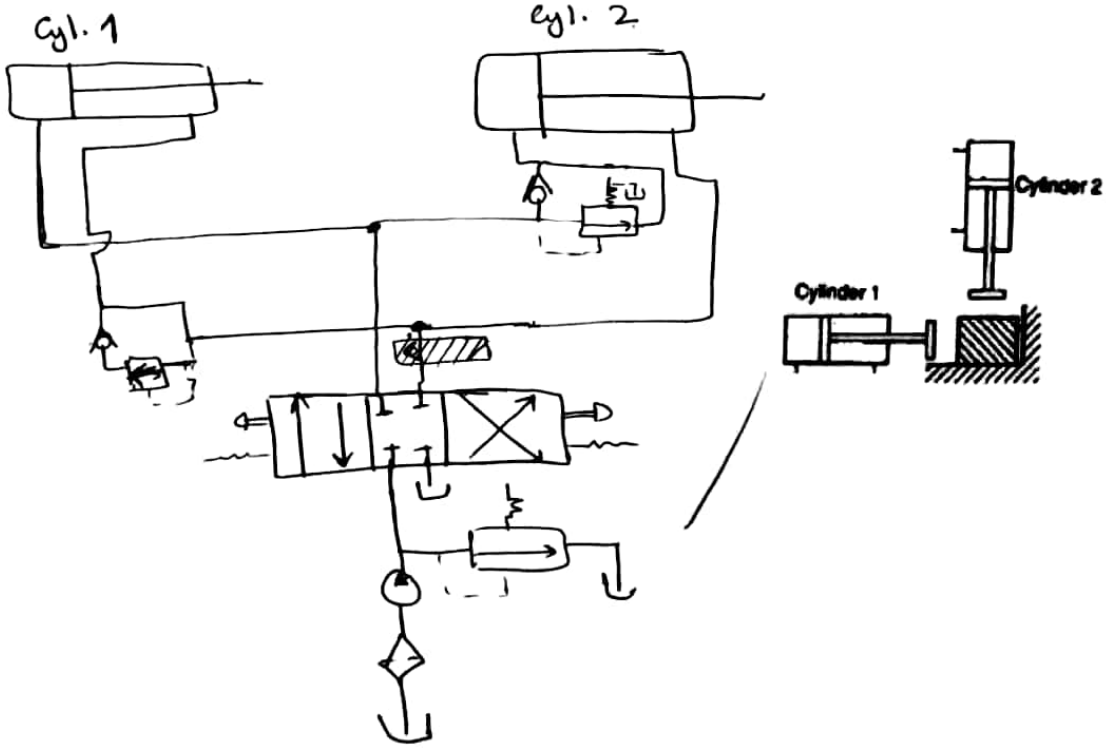
2. Draw the step motion diagram of the following circuit.





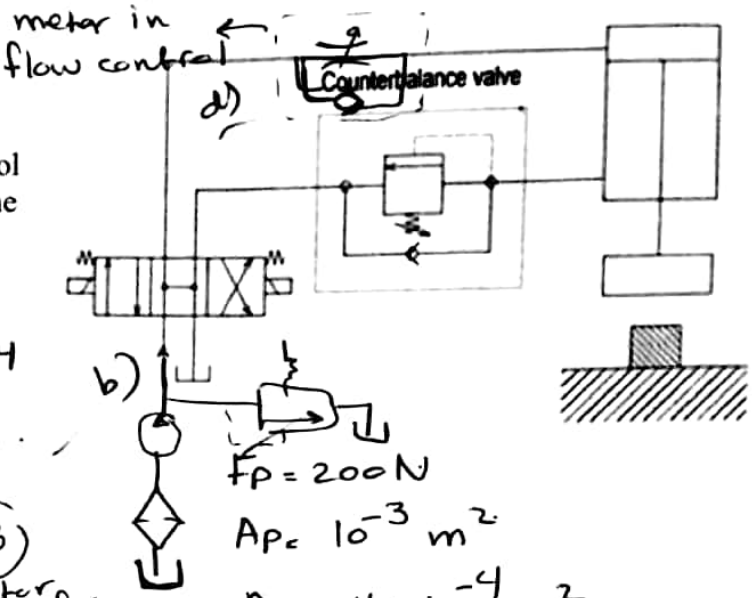
Question Three (6pts)

3. Given the nearby Hydraulic cylinders that are used to clamp and machine a workpiece. Cylinder-1 must be operated first to clamp the piece then it is followed by cylinder-2 to perform the machining. While the retraction of the cylinders can be in any order or together.
Design a Hydraulic circuit to operate the cylinders as stated using a push button valve without using any limit switch valves (Hint: use a sequence valve)



Question Four (6pts)

4. Given the following Hydraulic Press circuit with the following information: piston weight 200N, molten needed force 10000N, piston area $10cm^2$, rod area $4cm^2$, and pump flow rate $10m^3/hr$. For the nearby, find
   - a o setting for the counter balance valve.
   - b o Continue the pump circuit
   - c o Piston speed
   - d o Adjust the circuit to have a flow control
   - e o Can you guess how much should be the PRV setting!



a) $P_{back\ pressure} = \frac{F_P}{A_p - A_r} = \frac{200}{6 * 10^{-4}}$

$= 333.33\ kPa.$

$P_{counter\ balance} = 333.33 * (1.3)$ factor of safety.

$= 433.33\ kPa$

$A_p = 10^{-3}\ m^2$

$A_r = 4 * 10^{-4}\ m^2$

$A_p - A_r = 6 * 10^{-4}$

c) $v_p = \frac{q_p}{A_p} = \frac{10/3600}{10^{-3}} = 2.77\ m/s$ $\quad \frac{10\ m^3}{hr} * \frac{hr}{3600}$

e) $P_{at\ the\ full\ bore\ end\ of\ the\ piston} = 433.33 * \frac{6 * 10^{-4}}{10^{-3}}$

$= 259.998\ kPa.$

$P_{PRV} = \frac{10000}{10^{-3}} + 259.998 = 10.2599\ MPa.$