For all of the following design problems, you _must_ show the design procedures in details, otherwise no point will be got.

1. Show the (a) truth table; (b) excitation table; (c) next state equation; and (d) state transition diagram of a T-type flip flop. (10%)
2. How to design a D-type flip-flop by using a JK flip-flop and some gates. (10%)
3. What is the difference between frequency divisor and counter? Explain it with an example. (10%)
4. What is a Johnson counter? Explain it with an example (3-bit). (10%)
5. Design a module-5 asynchronous counter. (10%)
6. Use JK flip-flops to design a 3-bit up/down synchronous counter. (10%)
7. Analyzing the logic diagram shown in Fig.(a) and give (a) the transition table; (b) state transition diagram. (15%)
8. Design a sequential circuit with an input binary sequence x and an output z. The output z=1 after it receives exact two continuum bits of 1 each time. You must consider the asynchronous initialization signal. (15%)
9. Fig (b) shows the internal functional diagram of 555 IC chip. For the Fig. (c), explain its function and the detail operation principles, respectively. (10%)

Fig.(a)

Fig (b)

Fig.(c)