Please do not simplify any answers; no calculators are allowed.

1) A man has 5 shirts, 3 pants, and 23 shoes. How many outfits are possible? (4 points)

2) How many 12 bit strings have exactly one 1? (4 points)

3) At a renaissance fair, three people are needed for king, queen, and jester. There are 14 people that want to volunteer. How many ways can the king, queen, and jester be selected? (4 points)

4) In bridge you are dealt 13 cards from a standard deck of 52 cards. How many hands are there that contain all 4 aces? (4 points)

5) Find the number of solutions to $x_1 + x_2 + x_3 + x_4 = 12$, where each x_i is a nonnegative integer. (4 points)

6) A fair coin is flipped 10 times. What is the probability that it shows exactly 1 heads? (5 points)

7) An unfair coin is flipped 10 times. What is the probability that it shows exactly 1 heads? This coin has a $\frac{2}{3}$ probability of landing on heads. (5 points)

8) Two dice are rolled. What is the probability of getting a sum of 6 or 8 given that at least one die shows 2? (5 points)

9) A fair coin is flipped 10,000 times. Is it possible that it comes up heads every time? (5 points)

10) $100 is invested in an account with 5% annually compounded interest. How much money is in the account after 30 years? After n years? (5 points)

11) Consider the recurrence relation $a_n = 3a_{n-1} - 2a_{n-2}$. Find a closed form expression for the general solution a_n. (10 points)

12) Building on the previous problem, if $a_0 = 0$ and $a_1 = 1$, what is a_n? (5 points)

13) Write a grammar that generates the strings over $\{a, b\}$ starting with abb. (10 points)

14) Below is a state transition diagram for a finite state automaton.
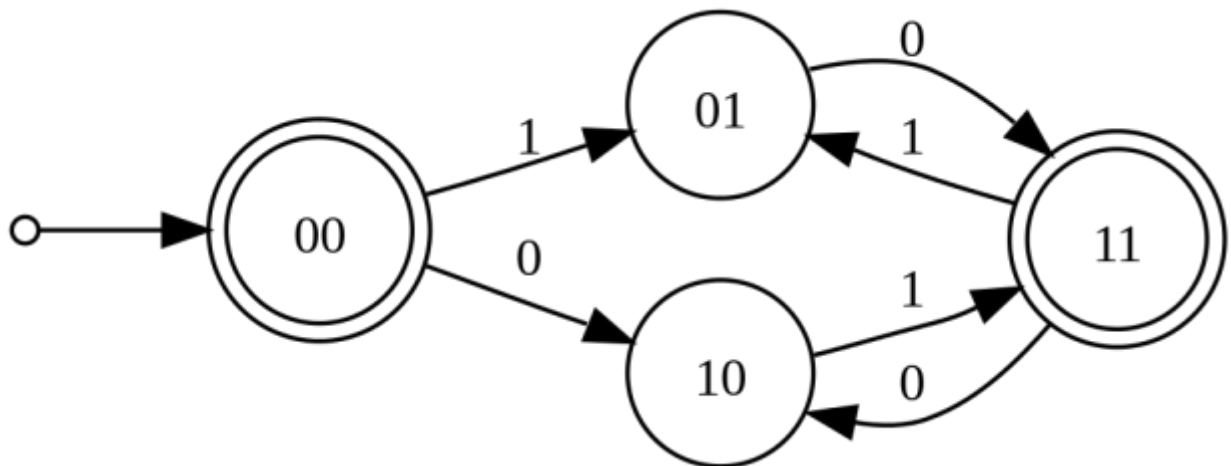
a) What are the accepting states? (2 points)

b) Is the input "011001" accepted? Clearly justify and/or illustrate your answer. (8 points)