#1 Consider the second stock market example in our textbook on p.807 but in this case, suppose now whether or not the stock market goes up tomorrow depends upon whether it increased today, yesterday, and the day before yesterday. Can the problem be formulated as a Markov Chain? If so, what are the possible states? Can you explain why these states give the process the Markov Property?

#2 A particle moves on a circle through points that have been marked 0, 1, 2, 3, 4 (in a clockwise order). The particle starts at point 0. At each step, it has a probability of 0.5 of moving one point clockwise (0 follows 4) and 0.5 of moving counter-clockwise. Let \( X_n, (n \geq 0) \) denote the location on the circle after step \( n \). \( \{X_n\} \) is a DTMC.

   a) Please construct the one-step transition matrix.

#3 Consider the following blood inventory problem facing a hospital. There is a need for a rare blood type, namely, type AB, Rh negative blood. The demand \( D \) (in pints) over any 3-day period is given by:

\[
P(D = 0) = 0.4, \quad P(D = 1) = 0.3
\]

\[
P(D = 2) = 0.2, \quad \text{and} \quad P(D = 3) = 0.1
\]

Note that the expected demand is 1 pint, since

\[
E(D) = 0.3(1) + 0.2(2) + 0.1(3) = 1.
\]

Suppose that there are 3 days between deliveries. The hospital proposes a policy of receiving 1 pint at each delivery and using the oldest blood first. If more blood is required than is on hand, an expensive emergency delivery is made. Blood is discarded if it is still on the shelf after 21 days. Denote the state of the system as the number of pints on hand just after a delivery. Thus, because of the discarding policy, the largest possible inventory state is 7.

   a) Construct the one-step transition matrix for the DTMC.

#4 Consider the inventory example discussed in class and in the book in Section 16.1. Suppose the following change in the ordering policy is decided. If the number of cameras on hand at the end of each week is 0 or 1, two additional cameras will be ordered. Otherwise, no ordering will take place.

   a) Construct the one-step transition matrix for the DTMC.