**EASTERN MEDITERRANEAN UNIVERSITY**



**Department of Industrial Engineering**

**IENG514 Stochastic Processes and Applications**

**HOMEWORK 2 Fall 2019-20**

1. A housewife buys three kinds of cereals (beans): A, B and C. She never buys the same cereal in successive weeks. If she buys cereal A, then the next week she buys B. However, if she buys either B or C, then the next week she is five times as likely to buy A as the other brands.
2. Find one step transition matrix for the chain.
3. With which probability she can buys all kind of cereals in consecutive four weeks?
4. What is the probability that after three week she will buy A if she buys C this week?
5. An urn contains *b* black and *r* red balls. A ball is drawn at random and is replaced after the drawing. The out coms at the *n*th drawing is either a black ball or a red ball. Let the random variable *Xn* be defined as:

*Xn*= 1, If *n*th drawing results in a black ball and *Xn*= 0, If *n*th drawing results in a red ball

Show that this processes cannot be a Markov chain.

1. Let *Xn* be a Markov chain with state space *{0,1,2}*, the initial probability vector and one step transition matrix 
2. Compute.
3. Compute.
4. Compute.
5. Compute 
6. Consider tow gamblers, each of them has $2. They start to play a game. One of them knows that respect his strategy in each round of the game the chance of win a dollar is 0.68 and the chance of lose a dollar is 0.22. Then he can keep his money with probability 0.1. The game ended when one of the gamblers lose all of his money.
7. Can the related stochastic process consider as the Markov chain?
8. Find the transition matrix.
9. What is the probability that the game ended in round 5?
10. What is the probability that the mentioned gambler win $2 after 7 rounds if at the beginning of the third he had $1?
11. What is the probability that he win in the first round lose in the second round lose in the third round and win in the fourth round?
12. Consider the tow state homogeneous Markov chain with the following unit-step transition matrix



1. By mathematical induction compute *P(m).*
2. Suppose that the initial probabilities are *P(X0=1)=0.25* and *P(X0=1)=0.75.*Compute *P(X0=1|X5=0)*.
3. Consider a counter to which customers arrive for service. There is one server who serves one customer (if any present) only at periods of time *0,1,2,… .* Assume that in the time interval *(n, n+1)*, number of customers *Yn* arrive where *n=0,1,2,3,4*  are random variables with *P(Y0)=0.15, P(Y1)=0.30, P(Y2)=0.25, P(Y3)=0.15, P(Y4)=0.15*. The waiting room can accommodate at most 10 customers including the one being served, if any. If *{Xn, n0}* can be the Markov chain, find the transitive matrix. If *P(X3=3)=0.4,*compute .
4. A Toyota dealer consumes four kinds of engine oil A, B, C and D. This dealer buys its consumption each week. The dealer never buys the same brand in successive weeks, except brand D. If the dealer buys engine oil D then with same probability it can buy all kinds of engine oils next week. If the dealer perches brand C then next week it will buy D. However, if the dealer buys engine oil B then the next week it is four times as likely to perches A as the other brands and finally if the dealer buy engine oil A it will buy D or C with same probabilities. What is the probability that mentioned dealer buys oil C when we know that oil B was purchased three weeks ago?
5. Classifiy the states of the following Markov Chain. Is this chain an ergodic chain?

