MA570 Spring 2020 Stochastic Methods Krigman

Quiz #1

NAME_____ **ID#**_____

Please show all your work for full credit and box off your answers.

Partial credit will be given when you show your work.

Good luck!

Suppose you have a Markov chain with four possible states {0, 1, 2, 3}. All problems below will deal with different (1 step) transition matrices for those states.

1. **Problem (20 pts total)**. (10 pts) Consider the following (one step) transition matrix:

States	**0**	**1**	**2**	**3**
0	0	1.0	0	0
1	0	0	1.0	0
2	0	0	0	1.0
3	1	0	0	0

   a) **(5 pts)** Draw a transition diagram.
   b) **(5 pts)** Indicate how many classes and which states belong to which classes.
   c) **(5 pts)** What is the period of every state in each class?
   d) **(5 pts)** What is the expected number of visits to state =1?

Assignment Project Exam Help

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2. **Problem (50 pts total).** Now, suppose you have values a1 and a2 representing transition probabilities, such that 0<a1<1 and 0<a2<1. Consider the following transition matrix:

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States	**0**	**1**	**2**	**3**
0	1-0	*	*	*
1	a1	0	*	0
2	a2	0	0	*
3	0	1.0	*	*

   a) **(5 pts)** Fill in the missing entries, marked with *.
   b) **(5 pts)** Draw a transition diagram. (Label transition probabilities in terms of a1 and a2).
   c) **(5 pts)** Identify number of classes; which elements belong to which class; periodicity of each class.
   d) **(5 pts)** Looking at your answer from part (b) determine the values of $p_{11}{}^{(2)}$, $p_{11}{}^{(3)}$, $p_{11}{}^{(4)}$, $p_{11}{}^{(5)}$, $p_{11}{}^{(6)}$ (You need to include a short explanation of how you got this answer.)
   e) **(5 pts)** Same question as (d) for p_{13} , $p_{13}{}^{(2)}$, $p_{13}{}^{(3)}$ (You need to include a short explanation of how you got this answer.)

In the next set of questions, assume a1=0.2, a2=0.1:

Also, the following formula for the sum of geometric series may be useful to you: $\sum_{n=0}^{\infty} x^n = \frac{1}{1-x}$ ***if*** $|x|<1$.

   f) **(5 pts)** Assuming the process starts in State=1, find the ***expected*** number of visits to that state.
   g) **(10 pts)** Find the expected number of visits to State=0.
   h) **(10 pts)** Does your answer to part (g) depend on where the process starts? Does your answer to part (f) depend on where the process starts?