FINAL EXAM EE - 302 Stochastic Processes
TAKE HOME EXAM

December 9, 2012

Due: Monday Dec.17, 12 noon

NAME

Please write clearly and underline or box your answers wherever you can.

1. 
2. 
3. 
4. 
5. 
6. 
7. 
8. 
9. 
10. 
11. 
12. 
13. 
14. 
15. 
16.
1. \{Sample Mean Realization\}
(10 points)

Problem 15.2 \{Let \ N = 1:500\}
2. \{Sample Mean Realization: Comparison of Convergence\} 
(10 points)

Problem 15.3 \{Let $N = 1:100$\}
3. { Estimating 2nd Moment of a Random Variable }  
(10 points) 
Problem 15.6 
Note: This is similar to what we did in class, where we estimated the mean using the sample mean: 
\[ E_X[X] = \frac{1}{N} \sum_{i=1}^{N} X_i \rightarrow E_X[X] \]
4. {Estimating Probability Using Law of Large Numbers} 
(10 points)
Problem 15.9 
Note: I get $Q(\sqrt[3]{2})$. 
5. {Determining approximate PDF from a sum of IID RVs}
(10 points)
Problem 15.13
Note: This is straightforward.
6. \{Determining Number of IID Variables Needed for desired Approximation Error\} 

(10 points)

Problem 15.19

Note: I get $Y_N = X_N - \frac{1}{2} \sim N(0, \frac{1}{12N})$.

Then, $P(|Y_N| \leq 0.01) = 1 - 2P(Y_N > 0.01)$. 

7. { Determining Approximate Probability for Carrying a Truckload of Oranges} (10 points)

Problem 15.20
8. {Describing a Random Process from a given activity}  
(10 points)

Problem 16.1
For each activity you have a sequence of numbers. What makes this sequence of numbers a random process?
9. {Determining Joint PMF for a Coin Tossing Experiment}\newline(10 points)

Problem 16.2
9. {Determining Finite Dimensional Distribution of a Bernoulli Random Process} 
(10 points)

Problem 16.4
10. {Classifying Random Processes} 
(10 points)

Problem 16.5
11. {Determining Statistics of a Stationary Random Process
(10 points)

Problem 16.8
12. {Determining Probability of an Event for an IID Random Process}  
(10 points)

Problem 16.9  
Note: We want \( P[X(0) > 1, X[1] > 1, X[2] > 1] \).
13. {Determining Mean Sequence and Autocorrelation Sequence of a WSS Process} (10 points)

Problem 17.1
Note: Since this is IID, it is of course also WSS.
Also:

\[ r_X[k] \equiv E(X[n]X[n+k]) = E(X[n])E(X[n+k]), \quad k \neq 0 \]

and

\[ r_X[k] = E(X[n]X[n]) = E(X^2[n]), \quad k = 0 \]

Now write an expression for \( r_X[k] \) for all \( k \).
14. {Determining if a RP is WSS}
(10 points)

Problem 17.6
15. {Determining WSS of a MA Random Process}  
(10 points)

Problem 17.20
16. {Determining PSD of a WSS Random Process} 
(10 points)

Problem 17.28
Note: Give a sketch of the PSD and explain it. That is, describe the frequency content at the low and high frequencies.