

Instructions: Please turn off your cell phones. You have 50 minutes to take this part of the exam. Relative point values are provided next to each problem. Please write **all** of your answers on a separate sheet of paper and make sure you have clearly labeled the problem corresponding to your answer. Unless otherwise mentioned, a_t denotes $WN(0, \sigma^2)$. Absolutely no cheating. I have planted a hidden camera in the room. Well, no camera, but the proctor will be watching you like a hawk. Make sure your answers are clearly stated. For instance, an answer to a Yes/No question that looks like ~~Yes~~ or ~~No~~ will automatically be graded as wrong! Part I of the exam has a total of 52 points and part II has 50 points totalling 102 points, but your score will be calculated out of 100 points. (You can thank me later.) **Good Luck!**

NAME: _____

- 1 (2 points) Here's an easy one to start off with. In the instructions it is mentioned that, unless otherwise stated, a_t denotes $WN(0, \sigma^2)$. What does WN stand for?
- 2 (3 points) What is required for a process Z_t to be covariance stationary?
- 3 (6 points) SARIMA stands for what six-word phrase?
- 4 (1+5=6 points) Consider the process $Z_t = \frac{a_{t-1} + a_t + a_{t+1}}{3}$.
 - (a) What is the value of the autocorrelation function at lag zero?
 - (b) What is the value of the autocovariance function at lag one?
- 5 (5 points) Using the methods described in class, solve the following difference equation

$$u_n = 2u_{n-1} - u_{n-2}$$

where $u_0 = 1$ and $u_1 = 3$. Be sure to clearly show the steps in your calculation.

- 6 (2+2+2+2=8 points) For this problem, assume a_t is Gaussian WN so that $a_t \sim N(0, \sigma^2)$ and consider the process $Z_t = a_t^2$. Answer the following questions with Yes or No.
 - (a) Is Z_1 independent of Z_3 ?
 - (b) Is Z_t a covariance stationary process?
 - (c) Is Z_t strictly stationary of order 2?
 - (d) Is Z_t strictly stationary (of all orders)?
- 7 (2+2+2+2=8 points) Consider the following process

$$Z_t = Z_{t-1} + a_t$$

Answer the first three parts with Yes or No.

- (a) Is Z_1 independent of Z_3 ?
 - (b) Is Z_t a covariance stationary process?
 - (c) Is Z_t strictly stationary of order 2?
 - (d) The process has a special name, what is it?
- 8 (2+3+4+5=14 points) Consider the process

$$Z_t = \delta + Z_{t-1} + a_t$$

and suppose the process starts at time zero with $Z_0 = 0$.

- (a) The constant δ is known as what? *Hint:* It's a one word answer that begins with the letter "d".
- (b) Compute $E[\nabla Z_t]$.
- (c) Compute $E[Z_t]$.
- (d) Compute $\text{var}(Z_t)$.