

Name: _____

Directions: MAKE SURE TO COPY YOUR ANSWERS TO A SEPARATE SHEET FOR SENDING ME AN ELECTRONIC COPY LATER.

1. (20) For a certain random variable X ,

$$P(X = i) = ci, \quad i = 1, 2$$

What is the value of c ?

2. (20) The `matrix()` function in R has an optional argument `byrow`. Here is an example:

```
> matrix(c(5,0,2,0,0,6,8,88,168), ncol=3,
         byrow=TRUE)
     [,1] [,2] [,3]
[1,]    5    0    2
[2,]    0    0    6
[3,]    8   88  168
```

Fill in the blank: This argument is used to conveniently input by rows, even though R uses _____ storage.

3. Consider the 3-heads-in-a-row example of Markov chains, Sec. 5.4.

- (a) (20) Look at the code on p.106, and think of what happens during the call to `findpil()`. The latter calls `solve()`. State the value of `imp` just before that call.
- (b) (10) Suppose spectators are watching this game, and every time the player tosses a tail after having two consecutive heads, the crowd moans, “Oh no!”, since the player came so close to winning but did not win. After the player has tossed the coin 10000 times, approximately how many times will the crowd have said “Oh no!”?

4. (15) Consider once again our Bus Ridership example, with the constraint added in Sec. 5.8 that the bus has a capacity of 20 passengers. But let’s change the distribution of the B_i to be Poisson with $\lambda = 0.1$. Find $p_{2,2}$.

5. (15) We wish to have a function that, for a given Markov transition matrix \mathbf{p} and given pair of states \mathbf{r} and \mathbf{s} will find $P(X_{i+k} = s \mid X_i = r)$ for any nonnegative integer k . Fill in the blanks:

```
> pkrs <- function(p,k,r,s) {
  pwr <- p
  if (k > 1)
    for (i in 1:(k-1))
      pwr <- # blank (a)
  # blank (b)
}
```

Solutions:

1. The probabilities must sum to 1, so $c = 1/3$.

2. column-major

3.a

$$\begin{pmatrix} 0.5 & -0.5 & -1 \\ -0.5 & 1 & 0 \\ 1 & 1 & 1 \end{pmatrix}$$

3.b 710

4.

$$\text{dbinom}(0,2,0.2) * \text{dpois}(0,0.1) + \text{dbinom}(1,2,0.2) * \text{dpois}(1,0.1) + \text{dbinom}(2,2,0.1) * \text{dpois}(2,0.2)$$

5.

```
> pkr  
function(p,k,r,s) {  
  pwr <- p  
  if (k > 1)  
    for (i in 1:(k-1))  
      pwr <- pwr %*% p  
  pwr[r,s]  
}
```