Name: ____________________________

Directions: **Work only on this sheet** (on both sides, if needed). MAKE SURE TO COPY YOUR ANSWERS TO A SEPARATE SHEET FOR SENDING ME AN ELECTRONIC COPY LATER.

Important note: Remember that in problems calling for R code, you are allowed to use any built-in R function, e.g. **choose()**, **sum()**, etc.

1. (5) The R analog of C++'s "." symbol that indicates member variables for a class instance (e.g. **x.y** is the member variable **y** in an instance x of some C++ class) is ________________.

2. (15) Write a single R statement that vectorizes the code

```
propgt15 <- 0
for (i in 1:length(x))
   if (x[i] > 1.5) propgt15 <- propgt15 + 1
propgt15 <- propgt1/length(x)
```

3. Write brief ONE-LINE explanations as to why each of the following statements is wrong:

(a) (10) "Say X has a N(0,1) distribution. Then P(X = t) is $\frac{1}{\sqrt{2\pi}} \exp\left(-0.5t^2\right)$.

(b) (10) "In the baseball data analysis, p.286, we are assuming that weight is equal to c + d × height, for some c and d."

(c) (10) "In the testing rule on p.224 top, 0.05 is interpreted as the probability that H_0 is true."

4. (20) Consider this simple Markov model of the reliability of a two-component system. The state is the number of machines currently up, thus 0, 1 or 2. If both machines are currently up, there is a probability p that one of them goes down in the next time step, and probability 1-p that both stay up. If exactly one is up, there is probability q that it goes down in the next time step, and probability 1-q that it stays up. Finally, any machine is that is currently down will have probability r of being repaired in the next time step, and probably 1-r of staying down. If both machines are down, their two repair processes are independent.

Write an R function **machinemodel()** that returns the π vector for this chain, with input parameters **p**, **q** and **r**. You should of course call the function **findpi1()**, given in the book.

Note: In your electronic file, put your entire **machinemodel()** on a single line, with appropriate braces and semicolons, e.g.

```
> minmax <- function(x) {mn <- min(x); mx <- max(x); c(mn,mx)}
> minmax(c(12,5,13))
[1]  5 13
```

5. (15) Suppose we have a random sample of size 25 from a beta-distributed population (Sec. 5.5.6) with $\alpha = 0.5$ and $\beta = 0.2$, and we compute the sample mean $\overline{X}$. Find the approximate (but not simulated) value of $P(\overline{X} > 0.72)$. Note: Your R expression may be somewhat complex. Make doubly sure that you've got it right, e.g. that your parentheses match up right.

6. (15) What is the name of the quantity returned by the following function?

```
f <- function(y,x) {
   lmout <- lm(y ~ x)
   # get the beta-hats
   betahat <- lmout$coef
   pred <- cbind(1,x) %*% betahat
   tmp <- cor(pred,y)
   tmp^2
}
```

Solutions:

1. $

2.

```
propgt15 <- mean(x > 1.5)
```

3.a For contin. distributions, P(X = t) = 0.

3.b It is mean weight, not weight.

3.c H_0 is either true or not (through all lines of the "notebook," no probability to it).

4.

```
machinemodel <- function(p,q,r) {
   m <- matrix(rep(0,9),nrow=3)
   r1 <- 1-r
   q1 <- 1-q
   m[1,1] <- r1^2
   m[1,2] <- 2*r*r1
   m[2,1] <- q*r1
   m[2,2] <- q*r+q1*r1
   m[3,2] <- p
   m[,3] <- 1-m[,1]-m[,2]
   findpi1(m)
}
```

5.

```
1 - pnorm(0.72, mean=0.5/0.7, sd=sqrt(0.1/(25*0.7^2*1.7)))
```

6. R^2