

1. What is the expected value of the following random variable

x	1	2	3	4	5	6
$P(X = x)$	0.25	0.4	0.15	0.05	0.1	0.05

```
x <- 1:6
px <- c(25, 40, 15, 5, 10, 5)/100
(m <- sum(x*px))                # mean, expected value

## [1] 2.5
```

2. Provide the R code to justify the 68, 95, 99.7 rule.

```
pnorm(1:3) - pnorm(-1:-3)

## [1] 0.6826895 0.9544997 0.9973002
```

3. Suppose adult heights are distributed normally with a mean of 71.5 inches and a standard deviation of 3.2 inches.

- (a) What is the probability we randomly select an adult who is between 64 and 78 inches tall?
- (b) What is the probability a randomly selected adult is less than 69 inches tall?
- (c) What is the probability a randomly selected adult is greater than 68.34 inches tall?
- (d) Below what value are the shortest 7.75% of adults?

```
mu <- 71.5
s <- 3.2
pnorm((78-mu)/s) - pnorm((64-mu)/s) # a

## [1] 0.9693397

pnorm((69-mu)/s)                # b

## [1] 0.2173277

1 - pnorm((68.34-mu)/s)         # c

## [1] 0.8383012

qnorm(0.0775)*s + mu           # d

## [1] 66.94931
```

4. Assume $X \sim U(a, b)$ is a continuous random variable. Calculate the expected value of the random variable X . Provide your work.

$$\begin{aligned} E(X) &= \int_a^b x f(x) dx \\ &= \int_a^b x \frac{1}{b-a} dx \\ &= \frac{x^2}{2(b-a)} \Big|_a^b \\ &= \frac{b^2 - a^2}{2(b-a)} \\ &= \frac{(b+a)(b-a)}{2(b-a)} \\ &= \frac{a+b}{2} \end{aligned}$$

This makes sense, the half way point between the points a and b should be $(a+b)/2$.