# Homework #03

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22 Feb 2021

## Chapter 03

### Problem 01

a. p(x) is a valid probability mass function $\frac{1}{4} + \frac{1}{2} + \frac{1}{8} + \frac{1}{8} = 1$
b. $P(X \geq 2) = \frac{1}{8} + \frac{1}{8} = \frac{1}{4}$
c. $P(X \geq 2 | X \geq 1) = \frac{1}{2} + \frac{1}{8} + \frac{1}{8} = \frac{5}{8}$
d. $P(X \geq 2 \bigcup X \geq 1) = \frac{1}{2} + \frac{1}{8} + \frac{1}{8} = \frac{5}{8}$

### Problem 03

$1 = C(1 + \frac{1}{2} + \frac{1}{4})$ $\frac{1}{C} = \frac{7}{4}$ $C = \frac{4}{7}$

### Problem 05

```
X <- c(0,1,2,3)
prob <- c(1/4, 1/2, 1/8, 1/8)
mean(sample(X, 10000, prob, replace=TRUE))
```

```
## [1] 1.1132
```

### Problem 07

```
d1 <- sample(c(1,2,3,4,5,6), 10000, replace=TRUE)
d2 <- sample(c(1,2,3,4,5,6), 10000, replace=TRUE)
mean(d1*d2)
```

```
## [1] 12.1601
```

### Problem 09

0:999 has 1000 numbers with 10 possible 2 digit numbers(0:9), 90 possible 3 digit numbers(10:99), and 900 3 digit numbers(100:999).

```
mean(sample(c(1,2,3), 10000, prob=c(1/1000, 90/1000, 900/1000), replace=TRUE))
```

```
## [1] 2.907
```

### Problem 11

Bernoulli trial, red being a win, with p = 18/38 a. Expected value is np, so the expected payout would be

$$\$1 * \frac{18}{38} = \$0.47$$

b. $P(A|B) = \frac{P(A\&B)}{P(B)} = \frac{\frac{18}{38} * \frac{18}{38}}{\frac{18}{38}} = \frac{18}{38}$ The expected payout would be $\$2 * \frac{18}{38} = \$0.97$

### Problem 14

Note: According to the website's probabilities, you can win a front pair and a straight so I am treating the "don't care" portions of the probabilities ignoring the better results. The other option would be to change front and back pair to 9/1000 instead of 1/100. This same logic will carry throughout the problem. a. $\frac{1}{10} * \frac{1}{10} * \frac{1}{10} = \frac{1}{1000}$ b. $\frac{1}{10} * \frac{1}{10} * \frac{10}{10} = \frac{1}{100}$ c. $\frac{10}{10} * \frac{1}{10} * \frac{1}{10} = \frac{1}{100}$ d. $\frac{3}{10} * \frac{2}{10} * \frac{1}{10} = \frac{6}{1000}$ e. f.

### Problem 15

$E[X] = \sum_1^k (X * p(x)) = \frac{k(k+1)}{2}$

### Problem 16

a.

```
test <- rbinom(10000, 20, .25)
(mean(test)/20)*100
```

```
## [1] 25.0595
```

b.

```
(sum(test>=10)/10000)
```

```
## [1] 0.0149
```

### Problem 17

a.

```
x <- rbinom(10000,10, .91)
mean(x)
```

```
## [1] 9.1049
```

b.

```
(sum(x >= 8)/10000)
```

```
## [1] 0.9421
```

**Problem 19**

X <- rbinom(trials, 200, .55) plot(table(X)) mean(X) var(X) # sd is sqrt(np(1-p)) sd(X) # margin of error 2*sd(X)/200 X < 100 # This is the event that prop A looks like it will fail

a. Expected number of votes:

```
x <- rbinom(10000, 200, .55)
mean(x)
```

```
## [1] 110.0675
```

b. Margin of error in percent of votes:

```
(2*sd(x))/200 * 100
```

```
## [1] 6.936076
```

c. Probability prop A will fail?

```
(sum(x<100)/10000)
```

```
## [1] 0.0631
```

d. $2\% = \frac{2*\sqrt{n(.55)(1-.55)}}{n}$ $(.01n)^2 = n(.55)(.45)$ $n = $

**Problem 21**

a. $P(y) : 1/4, y = -1; 1/2, y = 0; 1/8, y = 1; 1/8, y = 2$
b. $P(u) : 1/4, u = 0; 1/2, u = 1; 1/8, u = 4; 1/8, u = 9$
c. $P(v) : 1/2, v = 0; 3/8, v = 1; 1/8, v = 4$

**Problem 23**

```
X <- c(0,1,2,3)
prob <- c(1/4, 1/2, 1/8, 1/8)
y <- sample(X, 10000, prob, replace=TRUE)
```

Variance:

```
var(y)
```

```
## [1] 0.8815441
```

Standard Deviation:

```
sd(y)
```

```
## [1] 0.9389058
```