THEORETICAL PORTION

PROBLEM #1.

a. The max that can be drawn is $200, while the minimum could be $30. So for the interval of X, it represents 30 <= X <= 200. This also satisfies that f(x) is greater than zero for all x.

Total Win Amount	Bill Configuration (18 total)	PDF	CDF
$30	$10 $10 $10	0.01225	0.01980
$40	$10 $10 $20	0.01225	0.03960
	$10 $20 $10		0.03960
	$20 $10 $10		0.03960
$50	$10 $20 $20	0.00613	0.04950
	$20 $20 $10		0.04950
$60	$20 $20 $20	0.00123	0.05149
	$50 $10	0.13072	0.26271
	$10 $50		0.26271
$70	$50 $20	0.07843	0.38944
	$20 $50		0.38944
	$10 $10 $50	0.03268	0.44224
$80	$10 $20 $50	0.02451	0.48185
	$20 $10 $50		0.48185
$90	$20 $20 $50	0.00980	0.49769
$100	$50 $50	0.18301	0.79340
$110	$100 $10	0.03268	0.84620
	$10 $100		0.84620
$120	$10 $10 $100	0.00817	0.85941
	$100 $20	0.01961	0.89109
$130	$10 $20 $100	0.00613	0.90099
	$20 $10 $100		0.90099
$140	$20 $20 $100	0.00245	0.90495
$150	$100 $50	0.05229	0.98944
	$50 $100		0.98944
$160	None		0.98944
$170	None		0.98944
$180	None		0.98944
$190	None		0.98944
$200	$100 $100	0.00654	1.00000
		0.61887	
	MEAN	55.22059	

b. The mean of X = E(X) = (30*.01225)+(40*.01225)+(50*.00613)+…+(200*.00654) =
while the variance of X =

PROBLEM #2.

a. $E(X + 3Y + 3) = E(X) + 3E(Y) + 3 = 2 + 3(4) + 3 = 17$
b. $sd(X + 3Y + 3) = sd(X) + 3sd(Y) + 3 = 2 + 3(2) + 3 = 11$
c. $E(3X - 2Y - 5) = 3E(X) - 2E(Y) - 5 = 3(2) - 2(4) - 5 = -7$
d. $sd(3X - 2Y - 5) = 3sd(X) - 2sd(Y) - 5 = 3(2) - 2(2) - 5 = -3$

PROBLEM #3.

a.

PROBLEM #4.

a.

PROBLEM #5.

a. Cov(X,Y) Yes, the inversely related random variables can go below -1, even to negative infinity.
b. Yes, if the covariance is negative then the correlation must also be negative
c. Cov(100X,Y) when Cov(X,Y)=0.3 -> 100*Cov(X,Y) = 100*0.3 = 30
d. Corr(100X,Y) would take the sign of the 100, which is +, so this equals +0.1
e. $Cov(X,X) = E(X^2) - (E(X))^2 = Var(X)$
f. $Corr(X,X) = Cov(X,X)/Sqrt(Var(X))^2 = Var(X)/Var(X) = 1$
g. Cov(100X,10X) = 100*10*Cov(X,X) = 1000Var(X)
h. Corr(100X, 10X) = 1, since we’re only taking the sign of 100 and 10 (which is +)

COMPUTATIONAL PORTION

Code and graphs included with each part, not indexed.

PROBLEM #1 - COMPUTATIONAL

#1, part *a.*

code:

```
dgeom(7,.20)
```

output:

```
0.04194304
```

#1, part b.

code:

```
1 - pgeom(7,.20) - dgeom(7,.20)      #(P<=7) for pgeom, then subtract what's at 7 (dgeom)
```

output:

```
0.1258291
```

#1, part c.

PROBLEM #2 - COMPUTATIONAL

#2, part a.

code:

```
fx=function(x){
        value=((x)/((x^2)+1))
        return(value)
}
integrate(fx,0,2)
resultsg=integrate(fx,0,2)
c=1/resultsg$value
c

gx=function(x){
        fx(x)*c
}
```

output:

```
0.804719 with absolute error < 3e-10
1.24267
```

#2, part b.

code:

```
Gx=function(x){
        value=integrate(gx,0,x)
        return(value)
}


calculate.Info=function(x){
        cat(gx(x),"\n")
        cat(Gx(x)$value)
}

calculate.Info(.5)
```

PROBLEM #3 - COMPUTATIONAL

#3, part a.

code:

```
par(mfrow=c(2,2))

#α=1, β=1
hist((rweibull(n=5000, 1, scale =1)),freq=FALSE, col='lightblue',main="Weibell Distribution for α=1, β=1", ylim=c(0,1), xlab = "Random Variable (x)")
curve(dweibull(x, 1, scale =1), add=TRUE, col='red', lwd=1, text(3,.6,"Theoretical
 Distribution", col='red'))

#α=3, β=1
hist((rweibull(n=5000, 3, scale =1)),freq=FALSE, col='lightgreen',main="Weibell Distribution for α=3, β=1", ylim=c(0,1.2),xlab = "Random Variable (x)")
curve(dweibull(x, 3, scale =1), add=TRUE, col='red', lwd=1, text(1.7,.8,"Theoretical
 Distribution", col='red'))

#α=1, β=3
hist((rweibull(n=5000, 1, scale =3)),freq=FALSE, col='orange',main="Weibell Distribution for α=1, β=3", ylim=c(0,.3),xlab = "Random Variable (x)")
curve((dweibull(x, 1, scale =3)), add=TRUE, col='red', lwd=1, text(10,.2,"Theoretical
 Distribution", col='red'))

#α=3, β=3
hist((rweibull(n=5000, 3, scale =3)),freq=FALSE, col='yellow',main="Weibell Distribution for α=3, β=3", ylim=c(0,.5),xlab = "Random Variable (x)")
curve(dweibull(x, 3, scale =3), add=TRUE, col='red', lwd=1, text(5,.3,"Theoretical
 Distribution", col='red'))
```

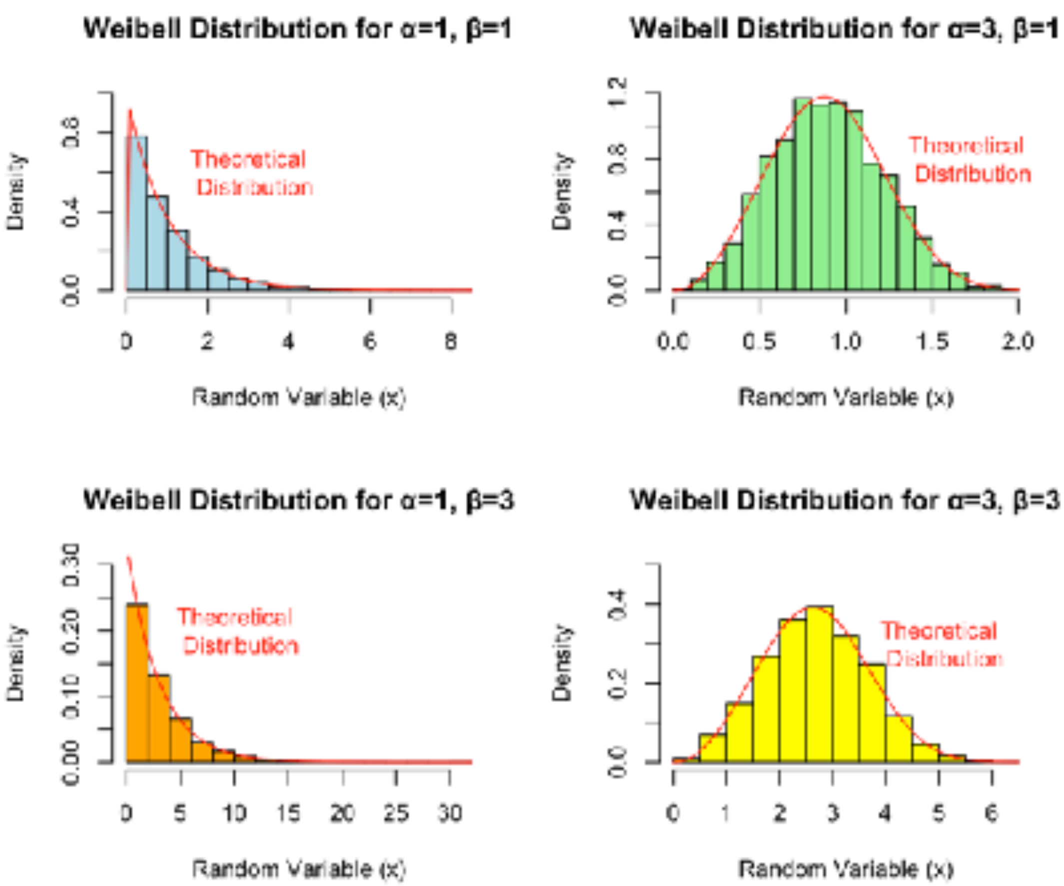
output:

PROBLEM #4 - COMPUTATIONAL

#4, part *a.*

code:

line 1



```
lightbulbs=rexp(7500,rate=.75)
        mean(lightbulbs)
        sd(lightbulbs)
```

output:

```
1.327306  #mean
1.343139  #standard deviation
```

theoretical:

$1/\lambda = 1/.75 = 1.333$ (repeating) or 4/3

#4, part b.

code:

line 1
```
sum(lightbulbs<=2)/7500
```

output:

```
0.7792
```

theoretical:

#4, part c.

code:

line 1
```
sum(lightbulbs>2)-sum(lightbulbs>4))/7500
```

output:

```
0.1738667
```

Just over 17% of the light bulbs will fail in between 2 to 4 years. This is expected as some bulbs will last longer than the mean, though the mean is at 1.3 years. And with a standard deviation of 1.3, the upper end of that spectrum is 2.6 years. So to last up to 4 years is impressive.