Probability Assignment Homework 2

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Solution 15

R program that takes an uniform distribution and generates random variables from an exponential distribution.

```r
library("ggplot2")
x<-runif(10000,min = 0,max = 1)
y<-dexp(x,rate = 3)
dat<-data.frame(x,y)
g<-ggplot(data=dat,aes(x=x,y=y))+ggtitle("X: Uniform Distribution, Y: Exponential Distribution")
g<-g+theme(plot.title = element_text(hjust = 0.5))+geom_line()
g
```


X: Uniform Distribution, Y: Exponential Distribution

Solution 18

```r
library("ggplot2")
```

  (a) Given: X~N(3,16)

To solve: P(X<7)

```r
x<-seq(-12,18,length = 1000)
y<-dnorm(x,mean=3,sd=sqrt(16))
dat<-data.frame(x,y)
g<-ggplot(data=dat,aes(x=x,y=y))+geom_line()+ggtitle("Normal Distribution")
g<-g+theme(plot.title = element_text(hjust = 0.5))
g<-g+xlab("X")+ylab("pmf(x)")+scale_x_continuous(breaks = c(-12,-9,-6,-3,0,3,6,7,9,12))
g<-g+geom_vline(xintercept = 7)
g<-g+geom_ribbon(data = dat[dat$x<7,],aes(x=x,ymax=y),ymin=0,fill="red", alpha=0.5)
g
```
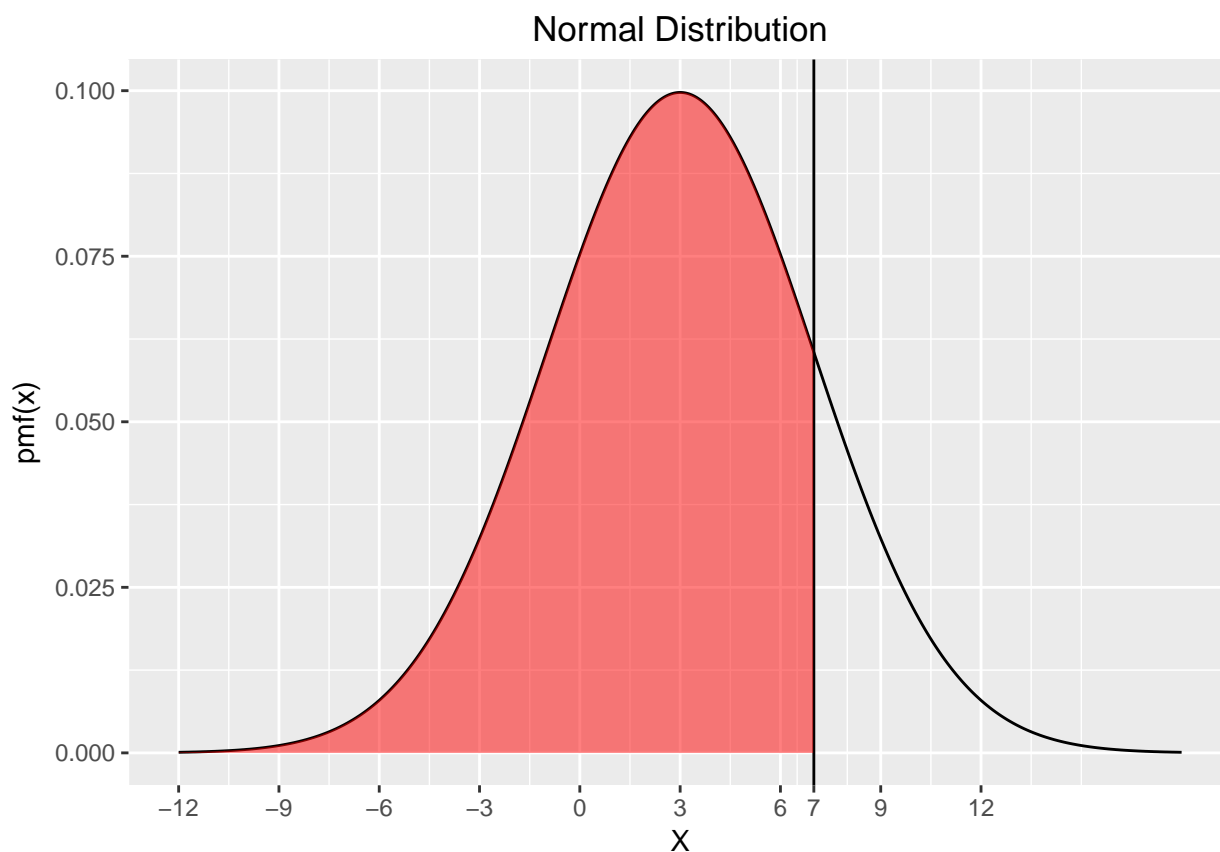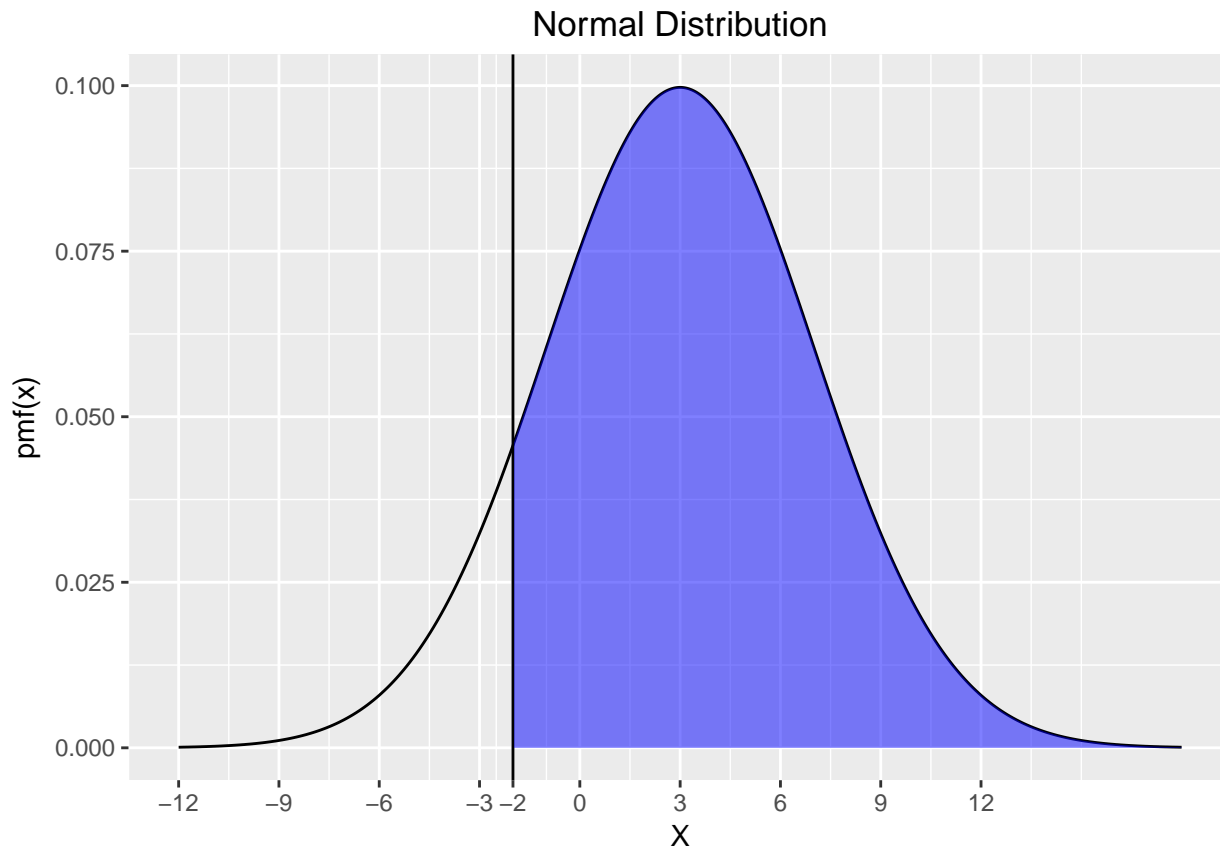


```r
pnorm((7-3)/(4),lower.tail = TRUE)
```

```
## [1] 0.8413447
```

2

(b) To solve: P(X>-2)

```r
g<-ggplot(data=dat,aes(x=x,y=y))+geom_line()+ggtitle("Normal Distribution")
g<-g+theme(plot.title = element_text(hjust = 0.5))
g<-g+xlab("X")+ylab("pmf(x)")+scale_x_continuous(breaks = c(-12,-9,-6,-3,-2,0,3,6,9,12))
g<-g+geom_vline(xintercept = -2)
g<-g+geom_ribbon(data = dat[dat$x>-2,],aes(x=x,ymax=y),ymin=0,fill="blue", alpha=0.5)
g
```



```r
#P(X>-2) = 1-P(X<=-2)
1-pnorm((-2-3)/(4),lower.tail = TRUE)
```

```
## [1] 0.8943502
```

3

(c) $P(X>x)=0.05$

```
xx=qnorm(0.05,mean = 3,sd = 4,lower.tail = FALSE)
g<-ggplot(data=dat,aes(x=x,y=y))+geom_line()+ggtitle("Normal Distribution")
g<-g+theme(plot.title = element_text(hjust = 0.5))
g<-g+xlab("X")+ylab("pmf(x)")+scale_x_continuous(breaks=round(c(-12,-9,-6,xx,0,3,6,round(xx,2),12),2))+geom_v
g<-g+geom_ribbon(data = dat[dat$x>xx,],aes(x=x,ymax=y),ymin=0,fill="orange", alpha=0.5)
g
```
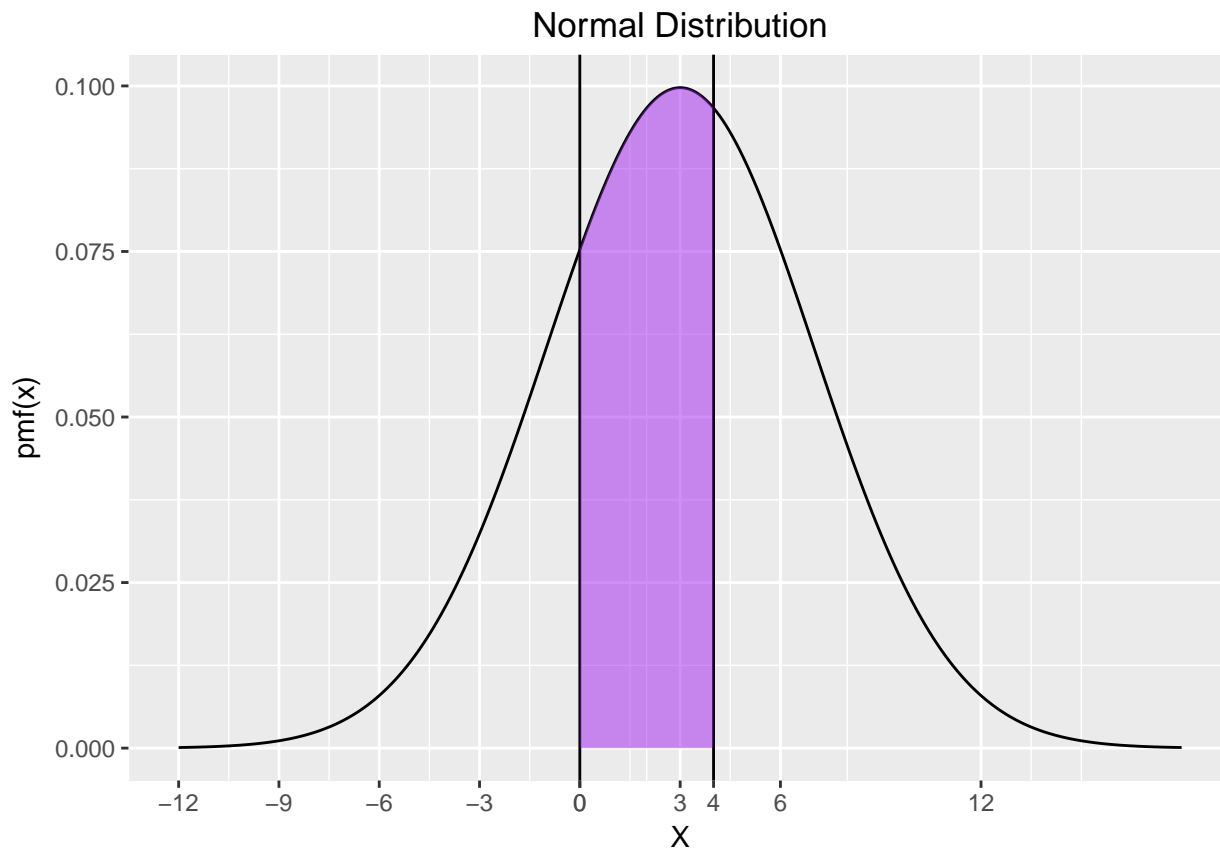

Normal Distribution
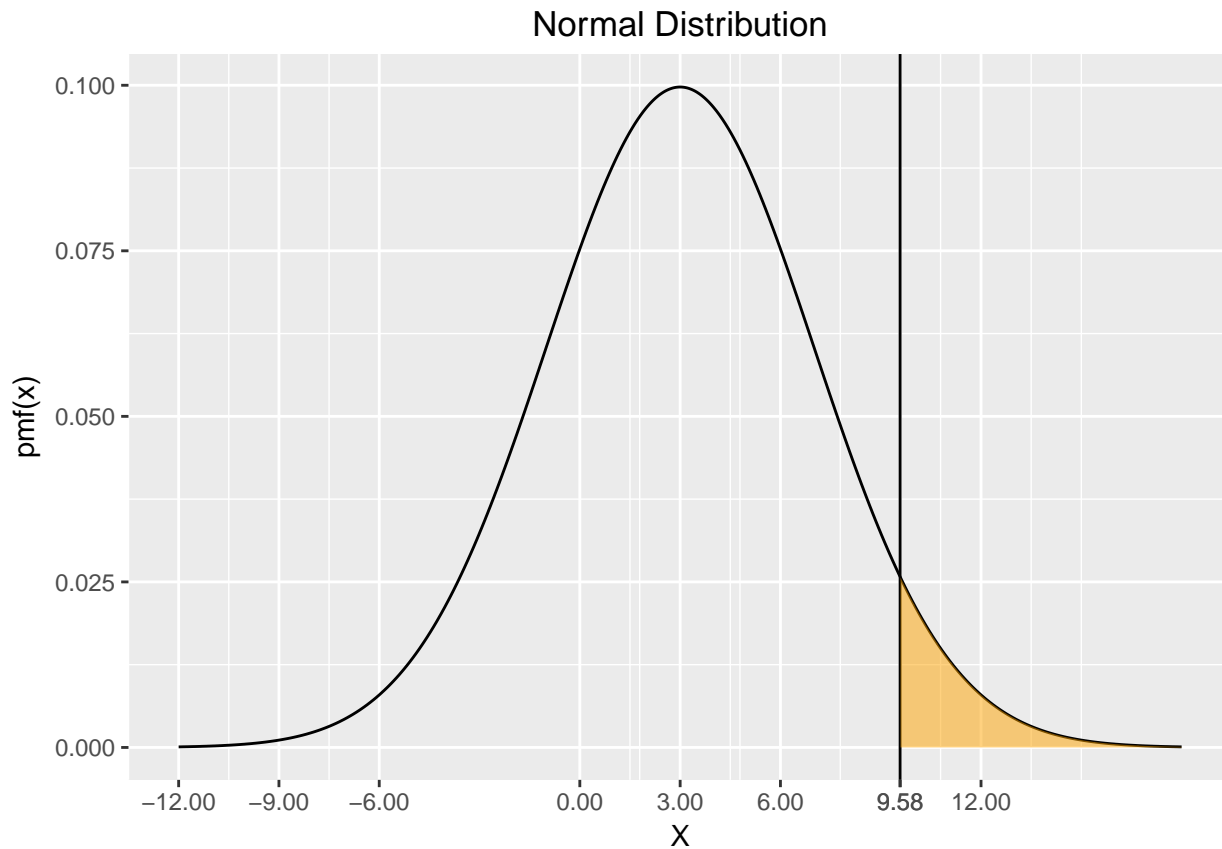
```
qnorm(0.05,mean = 3,sd = 4,lower.tail = FALSE)
```

```
## [1] 9.579415
```

(d) P(0<=x<4)

```
xx=c(0,4)
g<-ggplot(data=dat,aes(x=x,y=y))+geom_line()+ggtitle("Normal Distribution")
g<-g+theme(plot.title = element_text(hjust = 0.5))
g<-g+xlab("X")+ylab("pmf(x)")+scale_x_continuous(breaks = c(-12,-9,-6,-3,0,3,6,round(xx,2),12))+geom_vline(xi
g<-g+geom_ribbon(data = dat[dat$x>0 & dat$x<4,],aes(x=x,ymax=y),ymin=0,fill="purple", alpha=0.5)
g
```



```
pnorm((4-3)/(4),lower.tail = TRUE)-pnorm((0-3)/(4),lower.tail = TRUE)
```

```
## [1] 0.372079
```

(e) $P(|X|>|x|) = 0.05$

```
x_neg<-qnorm(0.05,mean = 3,sd = 4)
X_pos<-qnorm(0.05,mean = 3,sd = 4,lower.tail = FALSE)
xx<-round(c(x_neg,X_pos),2)
dat_red1<-dat[dat$x>X_pos,]
dat_red2<-dat[dat$x<x_neg,]
dat_red<-rbind(dat_red1,dat_red2)
g<-ggplot(data=dat,aes(x=x,y=y))+geom_line()+ggtitle("Normal Distribution")
g<-g+theme(plot.title = element_text(hjust = 0.5))
g<-g+xlab("X")+ylab("pmf(x)")+scale_x_continuous(breaks = c(-12,-9,-6,xx,0,3,6,12))
g<-g+geom_vline(xintercept = xx)
g<-g+geom_ribbon(data = dat_red1,aes(x=x,ymax=y),ymin=0,fill="brown", alpha=0.5)
g<-g+geom_ribbon(data = dat_red2,aes(x=x,ymax=y),ymin=0,fill="brown", alpha=0.5)
g
```
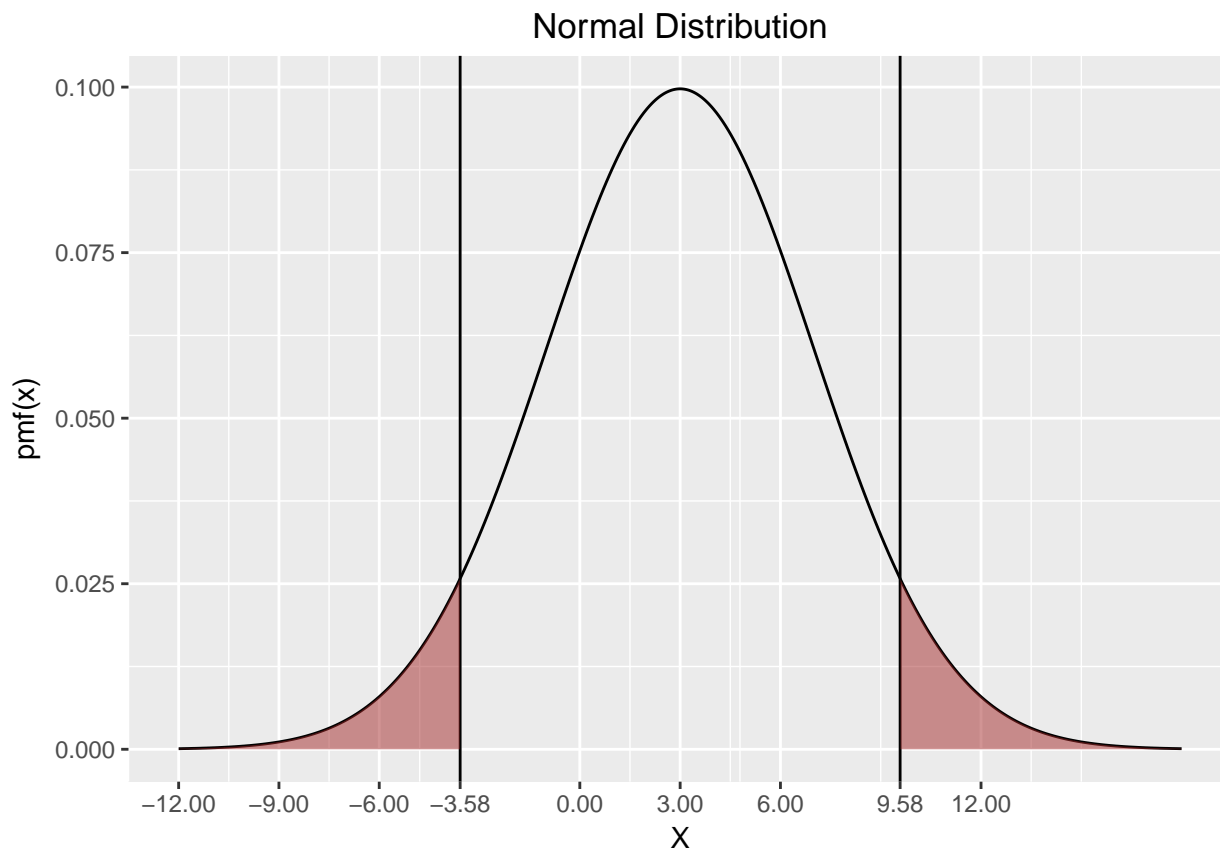


```
x_neg
```

```
## [1] -3.579415
```

```
X_pos
```

```
## [1] 9.579415
```

```
#Required x
```