Homework 5

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Question 1

a)

Men: M ~ N(4313, 583)

Women: W ~ N(5261, 807)

b)

Leo: (4948 - 4313) / 583 = 1.089

Mary: (5513 - 5261) / 807 = 0.312

c)

From the z value, Mary have a better result than Leo because Mary has a smaller z value.

```
1 - pnorm(q = 4948, mean = 4313, sd = 583)
```

```
## [1] 0.1380342
```

Leo finished faster than 13.80% of the participants

d)

```
1 - pnorm(q = 5513, mean = 5261, sd = 807)
```

```
## [1] 0.3774186
```

Mary finished faster than 37.74% of the participants.

e)

Yes, the probability will change since the distribution is not normal.

Question 2

a)

According to the Z-Table, the z value of the student who scored in the 80th percentile is z = 0.84. The observation will be 159.6729

b)

According to the Z-Table, the z value of the student who scored greater than 30% of the test taker is z = -0.52. The observation will be 147.36.

Question 3

a)

According to the Z-Table, the z value will be z = -1.645.

b)

The cut off time for the slowest 10% of athletes in the women's group will be 6293.96. Because based on the Z-Table, with the z value = 1.28 has the percentage equals to 10.

Question 4

a)

```r
1 - pnorm(83, mean = 77, sd = 5)
```

```
## [1] 0.1150697
```

The probability will be 11.51%.

b)

From the Z-Table, the z value will be -1.28 which represent the temperature around 70.6 Fahrenheit.

Question 5

a)

```r
pnorm(0, mean = 14.7, sd = 33)
```

```
## [1] 0.3279957
```

The probability of the portfolio being negative return will be 0.3280.

b)

```r
qnorm(0.85, mean = 14.7, sd = 33)
```

```
## [1] 48.9023
```

The 15% of returns will be 48.90% percent.

Question 6

a)

Yes, it can be used the binomial distribution because it have independent samples, the probability is constant, and there is only two outcome can exist.

b)

```r
dbinom(97, 100, .90)
```

```
## [1] 0.005891602
```

The probability of exactly 97 out of 100 randomly sampled American adults had chickenpox during childhood is 0.0059.

c)

```r
dbinom(3, 100, .10)
```

```
## [1] 0.005891602
```

The probability of exactly 3 3 out of a new sample of 100 American adults have not had chickenpox in their childhood is also 0.0059.

d)

```r
1 - dbinom(0, 10, .90)
```

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

The probability of at least 1 out of 10 randomly sampled American adults have had chickenpox is 1.

e)

```r
pbinom(3, 10, .10)
```

```
## [1] 0.9872048
```

The probability of at most 3 out of 10 randomly sampled American adults have not had chickenpox is 0.9872.

Question 7

a)

120 * 0.9 = 108 Var(people out of 120 that have chickenpox in their childhood) = 108 * 0.1 = 10.8 SD = $\sqrt{10.8} = 3.29$

b)

No, because 105 is less than one standard deviation.

c)

```r
pbinom(105, 120, .9)
```

```
## [1] 0.2181634
```

The probability of the people out of 120 that have chickenpox in their childhood is less than 105 is 0.2182.

Question 8

a)

```r
dbinom(2, 3, .25)
```

```
## [1] 0.140625
```

The probability of two children who have the disease is 0.1406.

b)

```r
dbinom(0, 3, .25)
```

```
## [1] 0.421875
```

The probability of none of the three children will have the disease is 0.4219

c)

```r
1 - dbinom(0, 3, 0.25)
```

```
## [1] 0.578125
```

The probability of at lease one of the three children do not carry the disease is 0.5781.

d)

$P(X = x) = (1 - p)^{x-1} * P = (1 - 0.25)^{x-1} * (0.25)$ $P(X = 3) = (1 - 0.25)^{3-1} * (0.25) = (0.75)^2 * (0.25) = 0.1406$ The probability of the fist children with the disease is the third child is 0.1406.

Question 9

Mean = 0.75 * 500 = 375 SD = $\sqrt{0.75 * 500 * (1 - 0.75)} = 9.6825$

a)

```r
pnorm(400, mean = 375, sd = 9.6825) - pnorm(360, mean = 375, sd = 9.6825)
```

```
## [1] 0.9344198
```

The probability between 400 and 600 of the drivers have the seat belt on is 0.9344.

b)

```r
pnorm(400, mean = 375, sd = 9.6825)
```

```
## [1] 0.9950882
```

The probability of fewer than 400 people wearing the seat belt is 0.9951.

c)

```r
1 - pnorm(400, mean = 375, sd = 9.6825)
```

```
## [1] 0.004911795
```

The probability of at most there are 400 people wearing the seat belt is 0.0049.

Question 10

a)

```r
pnorm(191, mean = 191, sd = 22.4)
```

```
## [1] 0.5
```

The probability of the diameter of trees that is above 191 inches is 0.5.

b)

```r
pnorm(190, mean = 191, sd = 22.4) - pnorm(180, mean = 191, sd = 22.4)
```

```
## [1] 0.170508
```

The probability of the diameter of trees between 180 and 190 inches is 0.1705.

c)

```r
qnorm(0.25, mean = 191, sd = 22.4)
```

```
## [1] 175.8914
```

The first 25% of the trees is 175.8914.

d)

```r
qnorm(0.75, mean = 191, sd = 22.4)
```

```
## [1] 206.1086
```

The third 25% of trees is 206.1086.

e)

The IQR will be 206.1086 - 175.8914, which will come up to 30.2172.