APLD STAT MTD BIOMED INFORMTCS
Assignment 3

Tianchuan Gao

2023-09-01

Question 1

(a)

$$E[X] = 100 * 0.13 = 13$$

Therefore, the expected number of smokers in a random sample of 100 students from this university is **13**

(b)

Question 2

(a)

```
1-pnorm(83,77,5)
```

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

the probability of observing an 83F temperature or higher in LA during a randomly chosen day in June is **0.115**

(b)

```
qnorm(.1,77,5)
```

```
## [1] 70.59224
```

temperature of the coldest 10% of the days during June in LA is **70.59**

Question 3

(a)

$X \sim bin(15, 0.45)$
$\mu = np = 15 * 0.45 = 6.75$
$\sigma = \sqrt{np(1-p)} = \sqrt{15 * 0.45 * 0.55} = 1.93$
expected value is **6.75** and standard deviation is **1.93**

(b)

$X \sim bin(15, 0.08)$

```
1-dbinom(0, 15, .08)-dbinom(1, 15, .08)-dbinom(2, 15, .08)
```

```
## [1] 0.1129651
```

the probability that 3 or more of the people in this sample could donate blood to a patient with Type O- blood is **0.113**

Question 4

$X \sim bin(250, 0.3)$

(a)

```
dbinom(60,250,.3)
```

```
## [1] 0.006301219
```

the probability that exactly 60 stocks are infected is **0.006**

(b)

```
pbinom(60,250,.3)
```

```
## [1] 0.02103864
```

the probability that at most 60 stocks are infected is **0.021**

(c)

```
sum(dbinom(80:250, 250, 0.3))
```

```
## [1] 0.2654606
```

the probability that at least 80 stocks are infected is **0.265**

(d)

```
pbinom(100,250,.3)
```

```
## [1] 0.9997024
```

take a random sample of 250 is reasonable

Question 5

(a)

```
1-pnorm(2.6)
```

```
## [1] 0.004661188
```

the probability that an outcome Z is greater than 2.60 is **0.005**

(b)

```
pnorm(1.35)
```

```
## [1] 0.911492
```

the probability that Z is less than 1.35 is **0.911**

(c)

```
pnorm(3.1) - pnorm(-1.7)
```

```
## [1] 0.9544669
```

the probability that Z is between -1.70 and 3.10 is **0.954**

(d)

```
qnorm(0.85)
```

```
## [1] 1.036433
```

cuts off the upper 15% of the distribution is **1.036**

(e)

```r
qnorm(0.2)
```

```
## [1] -0.8416212
```

the lower 20% of the distribution is **-0.842**

Question 6

(a)

```r
1 - pnorm(4948, 4313, 583)
```

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

13.8% of the triathletes in the group did he finish faster than

(b)

```r
1 - pnorm(5513, 5261, 807)
```

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

37.7% of the triathletes in the group did she finish faster than

(c)

```r
qnorm(0.05, 4313, 583)
```

```
## [1] 3354.05
```

cutoff time for the fastest 5% of athletes in the men's group is **3354**

(d)

```r
qnorm(0.9, 5261, 807)
```

```
## [1] 6295.212
```

cutoff time for the slowest 10% of athletes in the women's group is **6295**

Question 7

(a)

(b)

Yes, these data appear to follow a normal distribution.
points follow the line on the normal probability plot.

Question 8

(a)

$\lambda = 1, \mu = \lambda = 1, \sigma = \sqrt{\lambda} = 1$
the mean is **1** and the standard deviation is **2**

(b)

```
ppois(3, lambda = 1)
```

```
## [1] 0.9810118
```

the probability that this stenographer makes at most 3 typos in a given hour is **0.981**

(c)

```
1 - ppois(4, lambda = 3)
```

```
## [1] 0.1847368
```

the probability that this stenographer makes at least 5 typos over 3 hours is **0.185**

Question 9

(a)

$P(blue^c) * P(blue^c) * P(blue) = 0.875 * 0.875 * 0.125 = 0.096$

(b)

average number of children a pair of parents would have before having a blue-eyed child follows Geometric distribution
$\mu = 1/p = 8$
8 children would such a pair of parents have before having a blue-eyed child
$\sigma = \sqrt{(1-p)/p^2} = 7.483$
the standard deviation of the number of children they would expect to have until the first blue-eyed child is **7.483**

Question 10

(a)

42 entries are in the table for the joint distribution of X and Y
15 entries are 0

(b)

$$P(X = 1; Y = 0) = 1/6 * 1/2 = 1/12$$

(c)

$$P(X = 1; Y = 2) = 0$$

(d)

$$P(X = 6; Y = 3) = 1/6 * \begin{pmatrix} 6 \\ 3 \end{pmatrix} .5^3 * .5^3 = 0.052$$