3/25 TEAMWORK

TEAMWORK 1

- Household size in the United States has a mean of 2.6 people and standard deviation of 1.4 people. It should be clear that this distribution is skewed right as the smallest possible value is a household of 1 person but the largest households can be very large indeed. Then what is the probability that the mean size of a random sample of 100 households is more than 3?

```
> a<-(3-2.6)/(1.4/sqrt(100))
> pnorm(a,lower.tail = FALSE)
[1] 0.002137367
```

TEAMWORK 2

- The Swanson Auto Body business repaints cars that have been in an accident or which are in need of a new paint job. Its quality standards call for an average of 1.2 paint defects per door panel. Explain why there is a difference between the probability of finding exactly 1 defect when 1 door panel is inspected and finding exactly 2 defects when 2 doors are inspected.

Poisson Distribution Formula

$$P(X = x) = \frac{\lambda^x e^{-\lambda}}{x!}$$

```
> x<-2
> lambda<-2.4
> dpois(x,lambda)
[1] 0.2612677
```

TEAMWORK 3

- A mid-management team consists of 10 people, 6 males and 4 females. Recently top management selected 4 people from this team for promotion. It was stated that the selections were based on random selection. All 4 people selected were males. The females are upset and believe that there may have been more than random selection involved here. What probability distribution should be used to analyze this situation and what is the probability that all 4 promotions would go to males if the selections were random?

$$\frac{C_x^m C_{k-x}^n}{C_k^{m+n}}$$

```
> m<-6
> x<-4
> n<-4
> k<-4
> dhyper(x,m,n,k)
[1] 0.07142857
```

TEAMWORK 4

- It is assumed that the scores of students in a certain school are normal, with an average score of 70 points and a standard deviation of 5 points. Assuming that the passing criteria is 60 points and there are 1000 participants in an exam, how many people will pass the exam?

```
> xbar<-60
> mu<-70
> sd<-5
> z<-(xbar-mu)/sd
> p<-pnorm(z,lower.tail = FALSE)
> 1000*p
[1] 977.2499
```

TEAMWORK 5

- According to the US Census Bureau's American Community Survey, 87% of Americans over the age of 25 have earned a high school diploma. Suppose we are going to take a random sample of 200 Americans in this age group and calculate what proportion of the sample has a high school diploma. What is the probability that number of people with a high school diploma is less than 170?

```
> 170/200
[1] 0.85
> a<-(0.85-0.87)/sqrt((0.87*0.13)/200)
> pnorm(a,lower.tail = TRUE)
[1] 0.2001644
```

TEAMWORK 6

- Suppose a contract calls for, at most, 10 percent of the items in a shipment to be red. To check this without looking at every item in the large shipment, a sample of n = 10 items is selected. If 1 or fewer are red, the shipment is accepted; otherwise it is rejected. Then what is the probability that the shipment is accepted?

$P(X \leq 1)$

```
> n<-10
> p<-0.1
> k<-1
> pbinom(k,n,p,lower.tail = TRUE)
[1] 0.7360989
```

4/1 POP QUIZ

POP QUIZ 1

- The amount of drying time for the paint applied to a plastic component part is thought to be uniformly distributed between 30 and 60 minutes. Currently, the automated process selects the part from the drying bin after the part has been there for 50 minutes. Based on this, What is the probability that a part selected will not be dry?

```
> #1
> x<-50
> min<-30
> max<-60
> punif(x,min,max,lower.tail = FALSE)
[1] 0.3333333
```

POP QUIZ 2

- A class takes an exam where the average time to complete the exam is normally distributed with a time of 40 minutes and standard deviation of 9 minutes. If the class lasts 1 hour, what probability of the students will finish the exam after 60 minutes?

```
> #2
> z<-(60-40)/9
> pnorm(z)
[1] 0.9868659
```

POP QUIZ 3

- Watersports Rental at Flathead Lake rents jet skis and power boats for day use. Each piece of equipment has a clock that records the time that it was actually in use while rented. The company has observed over time that the distribution of time used is normally distributed with a mean of 3.6 hours and a standard deviation equal to 1.2 hours. Watersports management has decided to give a rebate to customers who use the equipment for less than 2.0 hours. Based on this information, what is the probability that a customer will get the rebate?

```
> #3
> z<-(2.0-3.6)/1.2
> pnorm(z)
[1] 0.09121122
```

POP QUIZ 4

- According to the statistics of the Police Department, there were 107,606 violations of drunk driving from January to November 2014, 62,950 cases transferred by the police, and 145 deaths caused by drunk driving. In addition, statistics show that 82% of deaths in drunk driving incidents are fatal. Now, if you take 18 drunk drivers, what is the probability of a 12 deaths caused by drunk driving?

```
> #4
> dbinom(12,18,0.82)
[1] 0.05835429
```

POP QUIZ 5

- The car wash owner cares about the number of vehicles washing in half an hour. It is assumed from the past information that the average number of vehicles in 30 minutes is 5, what is the probability of having 3 cars in 30 minutes? and what is the probability of having 1 car in 12 minutes?

```
> #5.1
> x<-3
> lambda<-5
> dpois(x,lambda)
[1] 0.1403739
```

```
> #5.2
> x2<-1
> lambda2<-(5/30)*12
> dpois(x2,lambda2)
[1] 0.2706706
```

POP QUIZ 6

- A certain company's customers is made up of 43% women and 57% men. An aggressive marketing campaign results in an increase of women customers to 46%, according to a sample survey of 50 customers. If the company hadn't run the campaign, what is the probability that 46% of customers are women? Was the campaign worth it?

```
> #6
> z<-(0.46-0.43)/sqrt((0.43*(1-0.43))/50)
> pnorm(z,lower.tail = FALSE)
[1] 0.3341494
```

POP QUIZ 7

- The honey produced on a farm is normally distributed with an average weight of 500 grams. A food inspection center selects 16 bottles of honey from the farm. The probability of 16 bottles of honey mean which is more than 510 grams is known to be 0.048, then what is the standard deviation of 16 bottles of honey?

```
> #7
> xbar<-510
> mu<-500
> n<-16
> z<-qnorm(0.048,lower.tail = FALSE)
> (10*sqrt(16))/z
[1] 24.03033
```

POP QUIZ 8

- A toy manufacturer will ship the finished product in units of 1000 per batch. Before shipment, 20 toys will be randomly selected for each batch. If more than 19 (including 19) pass the inspection, they can be shipped out smoothly; otherwise, the 1000 toys need to be returned to the quality control department for re-examination. Suppose there are 60 defective products in a certain batch of toys. What is the probability that these toys will not be shipped smoothly?

```
> #8
> m<-60
> n<-940
> x<-1
> k<-20
> 1-phyper(x,m,n,k,lower.tail = TRUE)
[1] 0.3400677
```

POP QUIZ 9

- According to past information, 5 out of an average of 100 passengers in the airline's reservations are temporarily unable to report to the flight (assuming different passengers will report to each other independently). Suppose the airline has 96 seats for a flight. In order to avoid the losses caused by unreported passengers, the airline allows 100 passengers to book a seat. What is the probability that there will be insufficient seats?

```
> #9
> 1-pbinom(96,100,0.95,lower.tail = TRUE)
[1] 0.2578387
```

POP QUIZ 10

- The average calorie of a can of beverage is known to be 105 (calorie) with a standard deviation of 4 (calorie). Today, 100 bottles of this canned beverage are randomly selected for inspection. What is the probability that the average calorie of 100 bottles of canned beverages is between 106 and 108?

```
> #10
> mu<-105
> sd<-4
> n<-100
> #P(106<X<108)
> zL<-(106-mu)/(sd/sqrt(n))
> zU<-(108-mu)/(sd/sqrt(n))
> pnorm(zU)-pnorm(zL)
[1] 0.006209665
```

4/15 TEAMWORK

TEAMWORK 1

- Suppose that a doctor claims that those who are 17 years old have an average body temperature that is higher than the commonly accepted average human temperature of 98.6 degrees Fahrenheit. A simple random statistical sample of 25 people, each of age 17, is selected. The average temperature of the sample is found to be 98.3 degrees. Further, suppose that we know that the population standard deviation of everyone who is 17 years old is 0.6 degrees. Is the doctor's claim correct or not ($\alpha = 0.01$)?

ANS

```
#H0: μ ≥ 98.6 H1: μ < 98.6
xbar<- 98.3
pmean<- 98.6
psd<- 0.6
n<- 25
Alpha<- 0.01
z<- (xbar-pmean)/(psd/sqrt(n))
z
CV<- qnorm(0.01)
CV
Pvalue<- pnorm(z)
Pvalue
Pvalue < Alpha
z < CV
```

```
> #H0: μ ≥ 98.6 H1: μ < 98.6
> xbar<- 98.3
> pmean<- 98.6
> psd<- 0.6
> n<- 25
> Alpha<- 0.01
> z<- (xbar-pmean)/(psd/sqrt(n))
> z
[1] -2.5
> CV<- qnorm(0.01)
> CV
[1] -2.326348
> Pvalue<- pnorm(z)
> Pvalue
[1] 0.006209665
> Pvalue < Alpha
[1] TRUE
> z < CV
[1] TRUE
```

TEAMWORK 2

- According to market research, it is stipulated that the bulbs produced can be used for 1200 hours. After formal production, 64 bulbs are tested, and the average is 1194 hours. The population variance is 36 hours. The test is marked with a significant level is 5%. Is the bulb manufactured by the factory compliant?

ANS

```
#H0 : μ = 1200, H1 : μ≠ 1200
xbar<- 1194
pmean<- 1200
psd<- sqrt(36)
n<- 64
Alpha<-0.05
z<- (xbar-pmean)/(psd/sqrt(n))
z
CVL<- qnorm(0.05/2)
CVU<- qnorm(1-(0.05/2))
c(CVL,CVU)
(z < CVL) | (z > CVU)

Pvalue<- 2*pnorm(z,lower.tail = TRUE)
Pvalue
Pvalue <  Alpha
```

```
> #H0 : μ = 1200, H1 : μ≠ 1200
> xbar<- 1194
> pmean<- 1200
> psd<- sqrt(36)
> n<- 64
> Alpha<-0.05
> z<- (xbar-pmean)/(psd/sqrt(n))
> z
[1] -8
> CVL<- qnorm(0.05/2)
> CVU<- qnorm(1-(0.05/2))
> c(CVL,CVU)
[1] -1.959964  1.959964
> (z < CVL) | (z > CVU)
[1] TRUE
> Pvalue<- 2*pnorm(z,lower.tail = TRUE)
> Pvalue
[1] 1.244192e-15
> Pvalue <  Alpha
[1] TRUE
```

TEAMWORK 3

- The ice shop is scheduled to open a branch in a certain location. According to experience, the location of the ice shop must be a large number of people, and the average hourly at least 100 people can be profitable. Assume that the planners of the ice shop observed 49 hours at the scheduled location, and the average pedestrian per hour was 106 and the population standard deviation of 10.5. Can they open an ice shop at this location($\alpha=0.01$)?

ANS

```
#H0：μ ≤ 100, H1：μ > 100
xbar<- 106
pmean<- 100
psd<- 10.5
n<- 49
Alpha<- 0.01
z<- (xbar-pmean)/(psd/sqrt(n))
z
CV<- qnorm(1-0.01)
CV
Pvalue<- pnorm(z,lower.tail = FALSE)
Pvalue
Pvalue < Alpha
z > CV
```

```
> #H0：μ ≤ 100, H1：μ > 100
> xbar<- 106
> pmean<- 100
> psd<- 10.5
> n<- 49
> Alpha<- 0.01
> z<- (xbar-pmean)/(psd/sqrt(n))
> z
[1] 4
> CV<- qnorm(1-0.01)
> CV
[1] 2.326348
> Pvalue<- pnorm(z,lower.tail = FALSE)
> Pvalue
[1] 3.167124e-05
> Pvalue < Alpha
[1] TRUE
> z > CV
[1] TRUE
```

TEAMWORK 4

- Tire manufacturers claim to produce at least 60,000 kilometers of tires. It is known that the mileage that the tire can travel is a normal distribution, and the standard deviation of population is 26,000 kilometers. Today, 16 tires are tested with an average mileage of 59,000 kilometers. Is the manufacturer's claim correct under 10% of the significant level?

ANS

```
#H0 : μ ≥ 60000, H1 : μ < 60000

xbar<- 59000

pmean<- 60000

psd<- 26000

n<- 16

Alpha<- 0.1

z<- (xbar-pmean)/(psd/sqrt(n))

z

CV<- qnorm(0.1)

CV

Pvalue<- pnorm(z,lower.tail = TRUE)

Pvalue

Pvalue

Pvalue < Alpha

z < CV
```

```
> #H0:μ ≥ 60000, H1:μ < 60000
> xbar<- 59000
> pmean<- 60000
> psd<- 26000
> n<- 16
> Alpha<- 0.1
> z<- (xbar-pmean)/(psd/sqrt(n))
> z
[1] -0.1538462
> CV<- qnorm(0.1)
> CV
[1] -1.281552
> Pvalue<- pnorm(z,lower.tail = TRUE)
> Pvalue
[1] 0.4388655
> Pvalue
[1] 0.4388655
> Pvalue < Alpha
[1] FALSE
> z < CV
[1] FALSE
```

TEAMWORK 5

- A brand mobile phone claimed that its average weight was 78 grams. Today, 10 of the brand's mobile phones were randomly selected, with an average weight of 80 grams with $\sigma = 4$ grams. Please verify that the manufacturer's claim is true at a significant level. (assuming the population conforms to the normal distribution and the significant level is 0.05)

ANS

```
#H0 : μ = 78, H1 : μ ≠ 78
xbar<- 80
pmean<- 78
psd<- 4
n<- 10
Alpha<-0.05
z<- (xbar-pmean)/(psd/sqrt(n))
z
CVL<- qnorm(0.05/2)
CVU<- qnorm(1-(0.05/2))
c(CVL,CVU)
(z < CVL) | (z > CVU)


Pvalue<- 2*pnorm(z,lower.tail = FALSE)
Pvalue
Pvalue <  Alpha
```

```
> #H0 : μ = 78, H1 : μ ≠ 78
> xbar<- 80
> pmean<- 78
> psd<- 4
> n<- 10
> Alpha<-0.05
> z<- (xbar-pmean)/(psd/sqrt(n))
> z
[1] 1.581139
> CVL<- qnorm(0.05/2)
> CVU<- qnorm(1-(0.05/2))
> c(CVL,CVU)
[1] -1.959964  1.959964
> (z < CVL) | (z > CVU)
[1] FALSE
> Pvalue<- 2*pnorm(z,lower.tail = FALSE)
> Pvalue
[1] 0.1138463
> Pvalue <  Alpha
[1] FALSE
```