Midterm_Vikrom_Narula_6081050

Name: Vikrom Narula ID: 6081050

Question 1

The following data represent the salary (baht) for a sample of 10 employees in a company: 18000 24000 9000 35000 27000 15000 28000 40000 33000 20000

a) (3 points) Find the average of salaries.

```
x <- c(18000, 24000, 9000, 35000, 27000, 15000, 28000, 40000, 33000, 20000)
mean(x)
```

```
## [1] 24900
```

b) (3 points) Find the median of the salaries.

```
median(x)
```

```
## [1] 25500
```

c) (3 points) Find the IQR of the salaries.

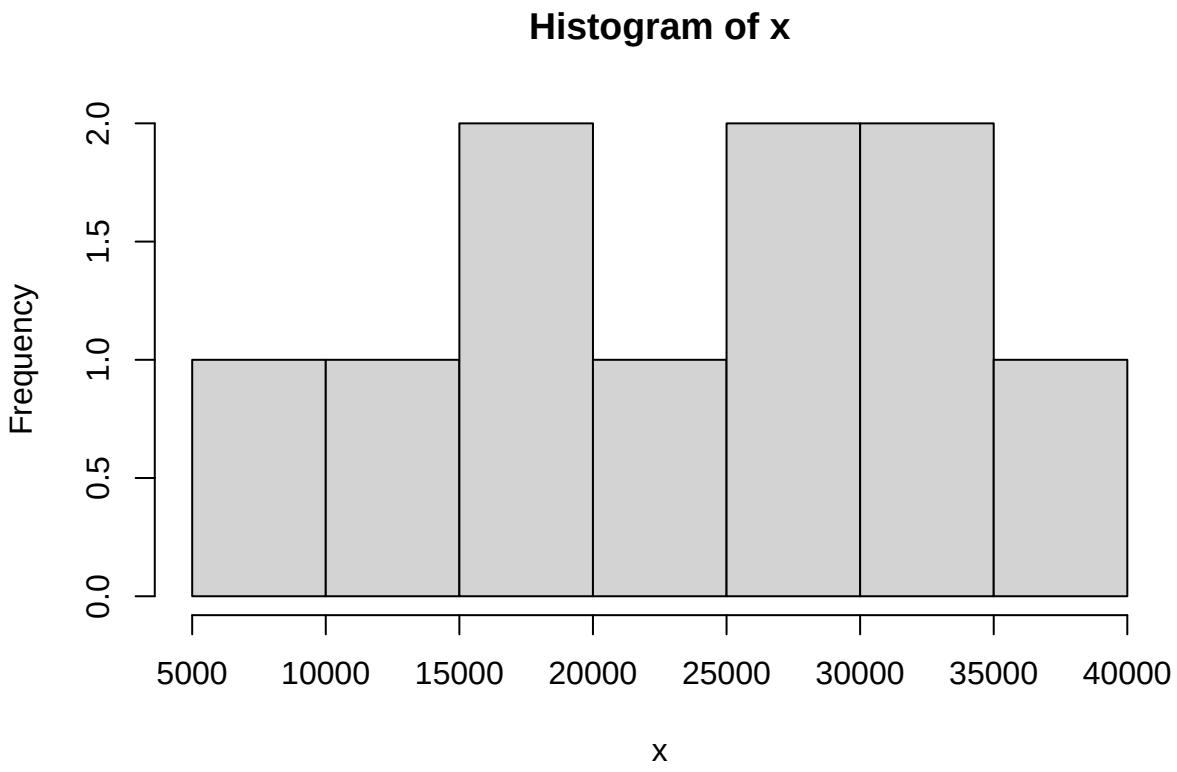
```
IQR(x)
```

```
## [1] 13250
```

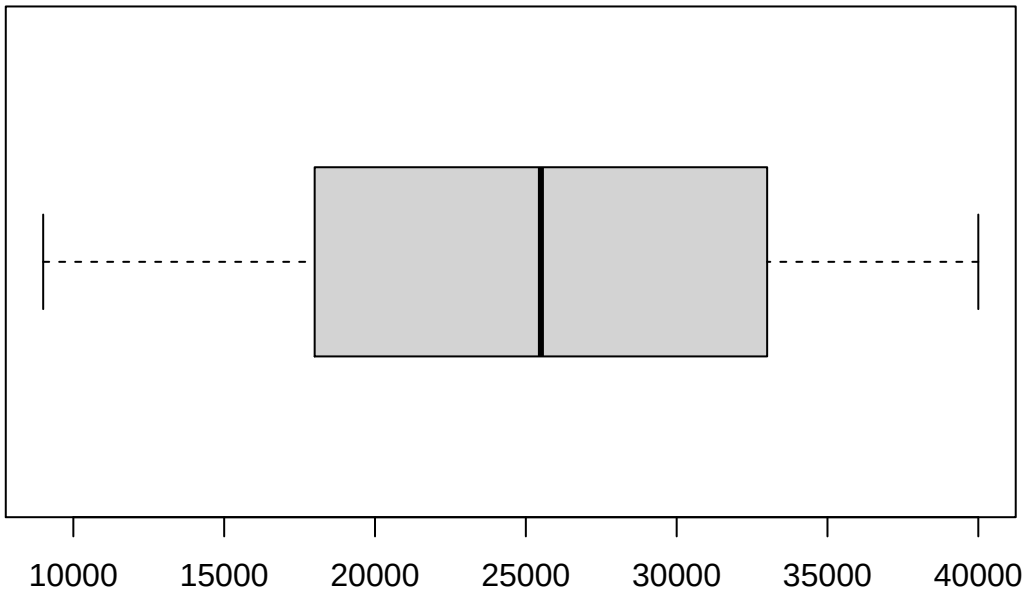
d) (3 points) Is the distribution of this dataset skewed? If so, is it right skewed or left skewed? Explain. **Answer**Due to mean < median it implies the data is left skewed slightly

e) (4 points) If we draw a box plot for this dataset, what are the upper whisker and the lower whisker of the box plot?

```
hist(x)
```




```
boxplot(x,horizontal=TRUE)
```




```
quantile(x)
```

```
##    0%   25%   50%   75%  100%
##  9000 18500 25500 31750 40000
```

Answer Lower = 18500 – 1.5 * 13250 = 1375 ut min is 9000 hence it's 9000; Upper = 31750 + 1.5 * 13250 = 51625 but max is 40000 hence it's 40000

Question 2

A random sample of 500 students are classified below by gender and their level of education. Education Male Female High School 46 54 100 Undergraduate 176 144 320 Graduate 38 42 80 260 240 500 a) (3 points) Find the probability that a randomly selected student is a male **Answer** P(M) = 260/500 = 13/25 b) (3 points) Find the probability that a randomly selected student is an undergraduate student. **Answer** P(Us) = 320/500 = 16/25 c) (4 points) Find the probability that a randomly selected student is a male graduate student. **Answer** P(M and Gs) = 38/500 = 19/250 d) (4 points) If the selected student is a female, find the probability that the student is a high school student. **Answer** P(Hs | F) = P(Hs and F) / P(F) = 46/500 * 500/240 = 46/240 = 23/120 e) (4 points) Find the probability that a randomly selected student is either a female or an undergraduate student. **Answer** P(F or Us) = P(F) + P(Us) - P(F and Us) = 240/500 + 320/500 - 144/500 = 416/500

Question 3

Let the random variable x be the weight of newborn baby (in kilogram). The probability distribution of x is shown below: x P(X=x) 2 0.1 2.5 0.2 3 0.4 3.5 0.2 4 0.1

a) (4 points) Find the expected weight (in kg.) of a newborn baby **Answer** E[X] = 0.1 * 2 + 0.2 * 2.5 + 0.4 * 3 + 0.2 * 3.5 + 0.1 * 4 = 3

b) (4 points) Find the standard deviation of weights of newborn babies. **Answer**

```
wt <- c(0.1, 0.2, 0.4, 0.2, 0.1)
x <- c(2, 2.5, 3, 3.5, 4)
mu <- weighted.mean(x,wt)
v1 <- sum(wt)
X <- (x - mu)**2
sd <- sqrt(sum(wt * X))
sd
```

```
## [1] 0.5477226
```

c) (4 points) Find the probability that a newborn baby has weight less than 3.5 kilogram. **Answer**0.1 + 0.2 + 0.5 = 0.8

d) (4 points) If we believe that the weight of a baby increases one kilogram per month, what is the average and variance of weights of babies with two months old.

```
wt <- c(0.1, 0.2, 0.4, 0.2, 0.1)
x <- c(3, 3.5, 4, 4.5, 5)
mu <- weighted.mean(x,wt)
v1 <- sum(wt)
X <- (x - mu)**2
vari <- (sum(wt * X))
print(mu)
```

```
## [1] 4
```

```
print(vari)
```

```
## [1] 0.3
```

Question 4

Identify each of the following variables as either quantitative or qualitative. a) (1 point) Rating of the effectiveness of a new cold remedy (Not effective, effective). **Answer** quantitative b) (1 point) Amount of time spent assembling a five-shelf bookcase. **Answer** quantitative c) (1 point) Number of children in a

beginning swimming class. **Answer** quantitative d) (1 point) University where a student is enrolled. **Answer** qualitative. e) (1 point) Color preference for a nursery. **Answer** qualitative. f) (1 point) Rating the U.S. foreign policy in the Middle East (fair, biased). **Answer** qualitative.

Question 5

Security Systems A home security system is designed to have a 99% reliability rate. Suppose that nine homes equipped with this system experience an attempted burglary. Find the probabilities of these events: a) (5 points) At least one of the alarms is triggered. **Answer** 0.08648275252 https://stattrek.com/online-calculator/binomial.aspx b) (5 points) More than seven of the alarms are triggered. **Answer** 0.000001 https://stattrek.com/online-calculator/binomial.aspx c) (5 points) Eight or fewer alarms are triggered.

```
pbinom(8,9,0.01)
```

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

Question 6

A radioactive mass emits particles according to a Poisson distribution. particles will be emitted one per two-second.

a) (5 points) What is the probability that one particle is emitted in a four-second period?

```
dpois(1,1/2 * 1/4)
```

```
## [1] 0.1103121
```

b) (5 points) What is the probability that no particles are emitted in a one-second period?

```
dpois(0,1/2 * 1)
```

```
## [1] 0.6065307
```

c) (5 points) What is the mean number of particles emitted per second? **Answer** $1/2 = 0.5$

Question 7

The fill volume of cans filled by a certain machine is normally distributed with mean 12.05 oz and standard deviation 0.03 oz.

a) (7 points) What proportion of cans contain less than 12 oz?

```
pnorm(q = 12,mean = 12.05,sd = 0.03)
```

```
## [1] 0.04779035
```

b) (7 points) The process mean can be adjusted through calibration. To what value should the mean be set so that 99% of the cans will contain 12 oz or more?

```
sqrt(log(0.99*sqrt(2*pi*0.03))/(-2*0.03^2))+12
```

```
## [1] 33.65885
```