

MSIT 431: PROBABILITY AND STATISTICAL METHODS

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Ques 1. Textbook Exercise 5.7

- Solution**
- (a) The population is the 153 English majors at your college.
 - (b) The sample is the 30 selected to be on committee.
 - (c) The statistic is the number or proportion from the 30 in favor of the change.
 - (d) The parameter would be the number or proportion of all 153 students who would like the new requirement.
 - (e) There are 153 English majors at college which is the population. Out of 153 English majors, 30 are selected randomly to be on a committee to evaluate changes in statistic. This equates to the sample of the Population randomly selected. Statistic is defined as the number that defines the sample. People who vote in the favor of change from the randomly selected 30 people would be the statistic.

Ques 2. Textbook Exercise 5.38

(a)

Mean loss from fire = \$500 per house

Standard deviation = \$10,000

It would be unwise to sell only 100 policies as the insurance company will earn revenue of \$50,000. Also not all 100 policy holder will file for claim together. With mean \$500, the probability of claims being more than the mean is quite high. Individual risk is typically quite large, however the customer average group risk is much smaller. The larger the customer base, the smaller the group risk.

(b) Price for policies = \$600

Policies sold = 50,000

Standard deviation = $\sigma_{\bar{x}} = \sigma / \sqrt{n}$

$= 10000 / 223.60$

$= 44.72$

We can get the probability that the average loss in a year will be greater than \$600 through $z = -2.236$, The approximate probability that the average loss in a year will be greater than \$600 is 1.25%.

Ques 3. Textbook Exercise 5.42

Ans 3. For x , mean=0.1 and for y mean=.9

$$R=0.7X+0.3Y$$

$$(0.7*0.1)+(0.3*0.09)=.097 \text{ or } 9.7\%$$

For x, standard deviation=.15 and for y standard deviation=.19

$$\sigma_R=(0.7 \sigma_x+0.3 \sigma_Y+(2\rho*0.7 \sigma_x *0.3 \sigma_Y))^{1/2}$$

$$\sigma_R = (0.22)^{1/2}$$

$$=.14 \text{ or } 14\%$$

(b) Mean=9.7, standard deviation = .14/(20) =0.03

the probability that her average return is less than 5% from R.

$$\text{pnorm}(0.05, 0.097, 0.032759) = 0.07568 = 7.568\%$$

(c) First year at 12%=1000(1+0.12)=1120

$$\text{Next year} = (1120)(1+0.06)=1187.2$$

$$\text{For mean return of 9\%, First year}=1000(1+0.09)=1090$$

$$\text{Next year}=(1090)(1+0.09)=1188.1$$

In the second case with 9 year return the portfolio earns more.

Ques 4. Textbook Exercise 5.7

Ans. Sample=1020

$$\text{Sample mean}=0.48$$

$$\text{Standard deviation}=(.48*.52/1020)^{1/2}=0.0156$$

$$P(0.44 \leq p \leq 0.52)=\text{pnorm}(0.52, 0.48, 0.01564) - \text{pnorm}(0.44, 0.48, 0.01564) =$$

$$0.9894586=98.95\%$$

Ques 5. Textbook Exercise 5.97

Ans.

$$P(X_i = 1)=0.6$$

$$P(X_i = -1)=0.4$$

$$\text{Mean}=0.6*1+0.4*-1=0.2$$

$$\text{Variance}=(1-0.2)^2*0.6+(-1-0.2)^2*0.4=.96$$

$$\text{Since } y=X_1+X_2+X_3+\dots+X_{500}$$

$$\mu_Y = \mu_{X_1} + \mu_{X_2} + \dots + \mu_{X_{500}}$$

$$\mu_Y = 500*0.2=100$$

$$\text{Similarly } \sigma_Y^2 = 500*.96=480$$

$$\sigma = 21.91$$

$$1-\text{pnorm}(200,100,21.91)=2.507898\text{e-}06$$

$$P(X_i=1)=0.6$$

$$P(X_i=-1)=0.4$$

$$\text{Mean}=0.6*1+0.4*-1=0.2$$

$$\text{Variance}=(1-0.2)^2*0.6+(-1-0.2)^2*0.4=.96$$

$$\text{Sample mean} = 500*0.2=100$$

$$\text{Sample standard deviation} = 500*0.96=480$$

$$Y \text{ is approximately normal } N(100,21.91)$$

$$1-\text{pnorm}(200,100,21.91)=2.507898\text{e-}06$$