

BIRZEIT UNIVERSITY
MATHEMATICS DEPARTMENT

SHORT EXAM 3

Stat 2311

Summer Semester 2018

Name..... Ken A Number.....

Dr. Hassan Abuhassan

number of questions = 3

Question # 1

The daily time spent by BZU students at the main library has a uniform distribution with a range from 30 minutes to 55 minutes. Now Answer questions 1 and 2

1. What is the probability that a student will spend at least 40 minutes on any given day?

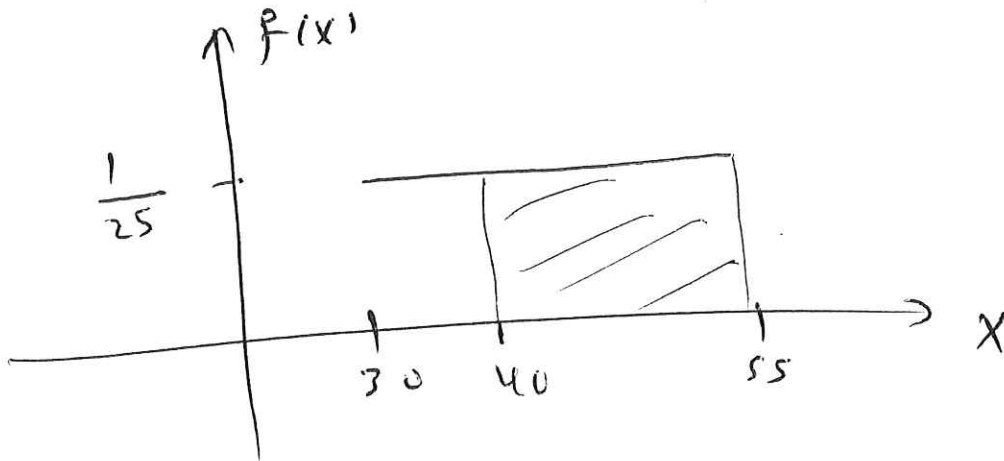
- 3 //
- a. 0.4
 - b. 0.6
 - c. 0.25
 - d. 0.75

$$P(X \geq 40) = (55 - 40) \left(\frac{1}{25} \right) = 0.6$$

2. What is the average daily time a student will spend at the main library?

- 3 //
- a. 35
 - b. 42.5
 - c. 52.5
 - d. 62.5

$$E(X) = \frac{30 + 55}{2} = 42.5$$



Question # 2

The mean cost for employee alcohol rehabilitation programs involving hospitalization is \$10,000 (*USA Today*, September 12, 1991). Assume the rehabilitation program cost has a normal probability distribution with a standard deviation of \$2200. Answer the following questions.

a. What is the probability that a rehabilitation program will cost at least \$12,000?

$$\begin{aligned}
 P(X \geq 12000) &= P\left(Z \geq \frac{12000 - 10000}{2200}\right) = \\
 &= P(Z \geq 0.91) \\
 &= 1 - P(Z \leq 0.91) \\
 &= 1 - 0.8186 \\
 &= 0.1814
 \end{aligned}$$

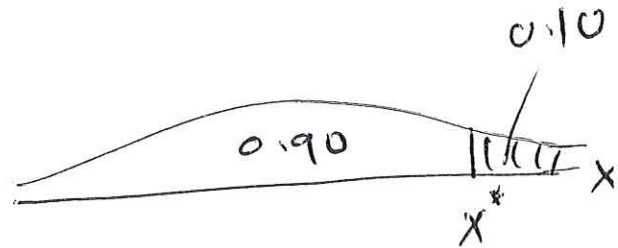
b. What is the cost range for the most expensive 10% of the rehabilitation programs?

$$\begin{aligned}
 0.10 &= P(Z \geq z^*) \Rightarrow \\
 0.90 &= P(Z \leq z^*) \Rightarrow
 \end{aligned}$$

$$z^* = 1.28$$

$$1.28 = \frac{x^* - 10000}{2200}$$

$$\begin{aligned}
 \Rightarrow x^* &= 10,000 + 1.28(2200) \\
 &= 12,816
 \end{aligned}$$



Cost range of the most expensive 10% of the rehab. prog. is $[12,816, \infty)$

Question # 3

The lifetime (hours) of an electronic device is a random variable with the following probability density function

$$f(x) = \begin{cases} \frac{1}{50} e^{-x/50} & \text{for } x \geq 0 \\ 0 & \text{otherwise} \end{cases}$$

Where x is measured in hours

I) What is the name of the probability distribution of x

- ✓/ a) Uniform b) Poisson c) Binomial **d) Exponential**

II) What is the mean lifetime of the device?

- ✓/ a) 25 **b) 50** c) 75 d) 90

III) What is the probability that the device will operate more than 50 hours before failure?

✓/ $P(X > 50) = e^{-50/50} = e^{-1} = \boxed{0.368}$

V) Let us assume that the company producing these electronic devices is considering a guarantee كفاالة that will provide a discount خصم on replacements if the original electronic device did not work for the number of months stated in the guarantee. What should the guarantee hours be if the company wants no more than 10% of the electronic devices be eligible for the discount guarantee?

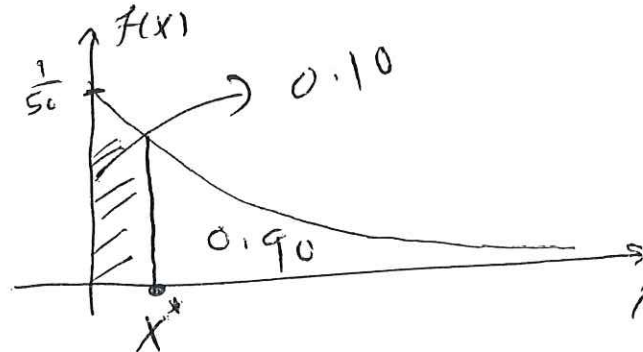
$$0.10 = P(X \leq x^*)$$

$$0.90 = P(X \geq x^*) = e^{-x^*/50}$$

$$\Rightarrow -x^*/50 = \ln(0.90) = -0.10536$$

$$\Rightarrow x^* = 50 (0.10536) = 5.27 \text{ hours}$$

\Rightarrow Guarantee Hours should be > 5.27 hours



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Question # 1

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The daily time spent by BZU students at the main library has a uniform distribution with a range from 30 minutes to 60 minutes. Now Answer questions 1 and 2

1. What is the probability that a student will spend at most 40 minutes on any given day?

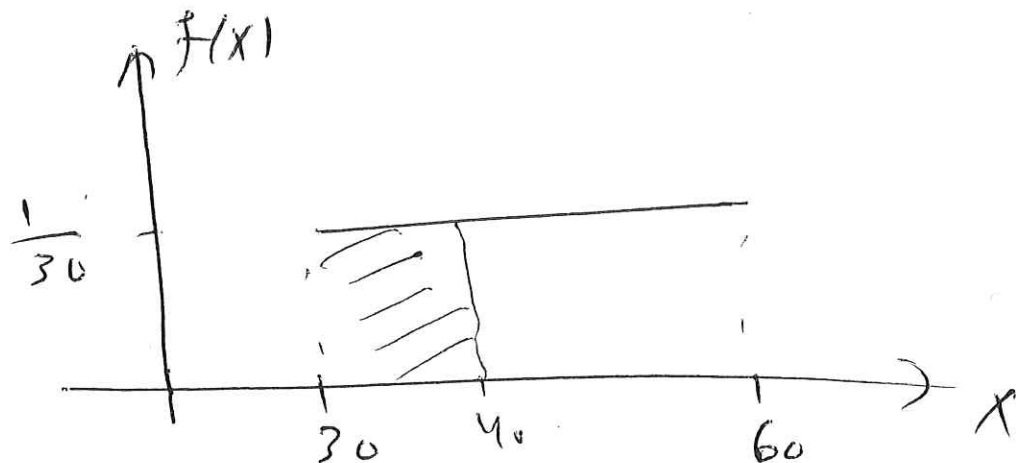
- 3
/
- a. 0.33
 - b. 0.40
 - c. 0.60
 - d. 0.75

$$P(X \leq 40) = (40 - 30) \frac{1}{30} = \frac{10}{30} = 0.33$$

2. What is the average daily time a student will spend at the main library?

- 3
/
- a. 35
 - b. 42.5
 - c. 45.0
 - d. 62.5

$$E(X) = \frac{30 + 60}{2} = 45$$



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Question # 2

The mean cost for employee alcohol rehabilitation programs involving hospitalization is \$11,000 (*USA Today*, September 12, 1991). Assume the rehabilitation program cost has a normal probability distribution with a standard deviation of \$1000. Answer the following questions.

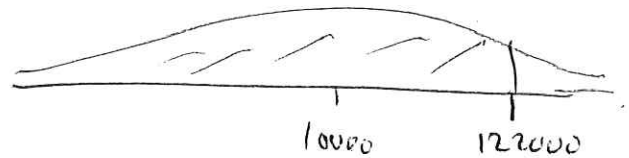
- a. What is the probability that a rehabilitation program will cost at most \$12,200?

$$P(X \leq 12200) = P\left(Z \leq \frac{12200 - 11000}{1000}\right)$$

$$= P(Z \leq 1.2)$$

$$= \cancel{0.7868}$$

$$= \boxed{0.8849}$$



- b. What is the cost range for the most expensive 15% of the rehabilitation programs?

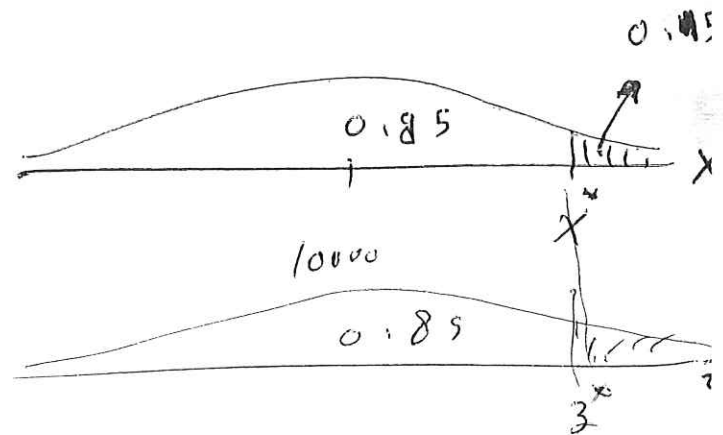
$$0.15 = P(X \geq X^*)$$

$$0.85 = P(X \leq X^*)$$

$$= P(Z \leq z^*)$$

$$z^* = 1.04$$

$$1.04 = \frac{X^* - 11000}{1000}$$



$$X^* = 11,000 + 1.04(1000) = \boxed{12040}$$

Cost range of the most expensive 15% is

$$X > \cancel{11,000} \text{ \$}$$

Question # 3

6

The lifetime (hours) of an electronic device is a random variable with the following probability density function

$$f(x) = \begin{cases} \frac{1}{25} e^{-x/25} & \text{for } x \geq 0 \\ 0 & \text{otherwise} \end{cases}$$

Where x is measured in hours

I) What is the name of the probability distribution of x

1

- a) Uniform (b) Exponential c) Binomial d) Poisson

(II) What is the mean lifetime of the device?

1

- (a) 25 b) 50 c) 75 d) 90

(III) What is the probability that the device will operate less than 50 hours before failure?

2

$$\begin{aligned} P(X < 50) &= 1 - e^{-50/25} = 1 - e^{-2} \\ &= 1 - 0.135 \\ &= \boxed{0.8647} \end{aligned}$$

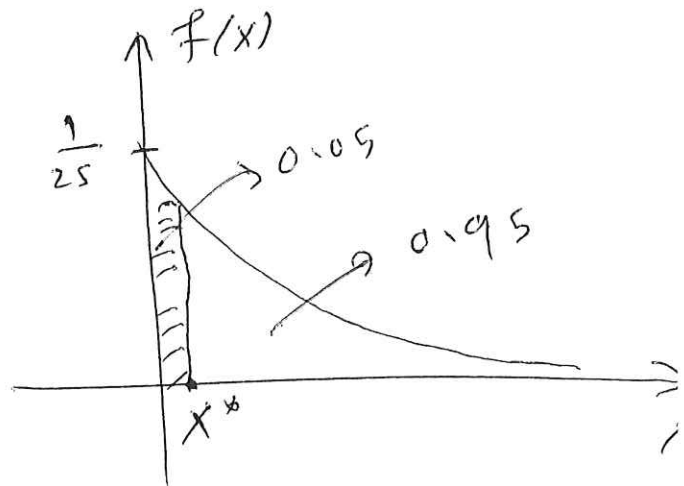
V) Let us assume that the company producing these electronic devices is considering a guarantee كفالة that will provide a discount خصم on replacements if the original electronic device did not work for the number of months stated in the guarantee. What should the guarantee hours be if the company wants no more than 5% of the electronic devices be eligible for the discount guarantee?

2

$$0.05 = P(X \leq X^*)$$

$$\begin{aligned} 0.95 &= P(X > X^*) \\ &= e^{-X^*/25} \end{aligned}$$

$$\ln(0.95) = -\frac{X^*}{25}$$



$$\begin{aligned} X^* &= -25 \ln(0.05) = 1.28 \text{ Hours} \\ \Rightarrow \text{Guarantee Hours should be } &> 1.28 \text{ hours.} \end{aligned}$$

