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**ASSIGNMENT 2-SET2**

**Topics: Normal distribution, Functions of Random Variables**

1. The time required for servicing transmissions is normally distributed with *μ* = 45 minutes and *σ* = 8 minutes. The service manager plans to have work begin on the transmission of a customer’s car 10 minutes after the car is dropped off and the customer is told that the car will be ready within 1 hour from drop-off. What is the probability that the service manager cannot meet his commitment?
2. 0.3875
3. 0.2676
4. 0.5
5. 0.6987

ANSWER :

Pr(X > 50) = 1 - Pr(X ≤ 50).

Z = (X - 45)/8.0

Thus the question can be answered by using the normal table to find

Pr(X ≤ 50) = Pr(Z ≤ (50 - 45)/8.0)

= Pr(Z ≤ 0.625)

=73.4%

Probability of given

= 100-73.4 = 26.6% or 0.2676.

So option B.

1. The current age (in years) of 400 clerical employees at an insurance claims processing center is normally distributed with mean *μ* = 38 and Standard deviation *σ* =6. For each statement below, please specify True/False. If false, briefly explain why.
2. More employees at the processing center are older than 44 than between 38 and 44.
3. A training program for employees under the age of 30 at the center would be expected to attract about 36 employees.

We have a normal distribution with = 38 and = 6. Let X be the number of employees. So according to question

a)Probabilty of employees greater than age of 44= Pr(X>44)

ANSWER:

Pr(X > 44) = 1 - Pr(X ≤ 44).

Z = (X - 38)/6

Thus the question can be answered by using the normal table to find

Pr(X ≤ 44) = Pr(Z ≤ (44 - 38)/6) = Pr(Z ≤ 1)=84.1345%

Probabilty that the employee will be greater than age of 44 = 100-84.1345=15.86%

So the probability of number of employees between 38-44 years of age = Pr(X<44)-0.5=84.1345-0.5= 34.1345%

So more employees at the processing center are older than 44 than between 38 and 44” is FALSE.

b) Probabilty of employees less than age of 30 = Pr(X<30).

Z = (30 - 38)/6

ANSWER :

Pr(X ≤ 30) = Pr(Z ≤ (30 - 38)/6) = Pr(Z ≤ -1.333)=9.12%

So the number of employees with probability 0.912 of them being under age 30 = 0.0912\*400=36.48( or 36 employees).

Therefore the statement B of the question is also TRUE.

1. If *X1* ~ *N*(μ, σ2) and *X*2 ~ *N*(μ, σ2) are *iid* normal random variables, then what is the difference between 2 *X*1 and *X*1 + *X*2? Discuss both their distributions and parameters.

ANSWER:

If X ∼ N(µ1, σ1^2 ), and Y ∼ N(µ2, σ2^2 ) are two independent random

2 is larger scale of the random variable *X1.*

If is normally distributed then 2X1 is also normally distributed.

Two parameters *X*1 and *X*2 are normal distributed.

1. Let X ~ N(100, 202). Find two values, *a* and *b*, symmetric about the mean, such that the probability of the random variable taking a value between them is 0.99.
2. 90.5, 105.9
3. 80.2, 119.8
4. 22, 78
5. 48.5, 151.5
6. 90.1, 109.9

ANSWER:

Z=(X- μ) / σ

Probability 0.005 the Z Value = -2.57

X=Z \* σ + μ

Z(-0.005)\*20+100 = -(-2.57)\*20+100 = 151.4

Z(+0.005)\*20+100 = (-2.57)\*20+100 = 48.6

So, option D is correct.

1. Consider a company that has two different divisions. The annual profits from the two divisions are independent and have distributions Profit1 ~ N(5, 32) and Profit2 ~ N(7, 42) respectively. Both the profits are in $ Million. Answer the following questions about the total profit of the company in Rupees. Assume that $1 = Rs. 45
2. Specify a Rupee range (centered on the mean) such that it contains 95% probability for the annual profit of the company

ANSWER:

μ ± 2σ

= 540 ± 2\*225

= 540 ± 450

= (540 - 450, 540 + 450)

=RANGE OF (90,990)

1. Specify the 5th percentile of profit (in Rupees) for the company

ANSWER:

= μ - 1.5σ

=540 - (1.5 \* 225)

=202.5(In Millions)

1. Which of the two divisions has a larger probability of making a loss in a given year?

ANSWER:

division1= Z score for a profit of zero: Z=(X-µ)/ *s.d*

*=*  (0-5)/3

= -1.66=0.0485

division2= Z score for a profit of zero: Z=(X-µ)/ *s.d*

=(0-7)/4

= -1.75= 0.0401

Division 2 has a larger probability of making a loss in a given year