**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

**SOLUTION =** *μ* = 45 minutes,*σ* = 8 minutes

Since the work begins after 10mins, *μ* = 55 minutes

Probability that the service manager cannot meet his commitment =

1-stats.norm.cdf(60,55,8)

**0.2676**

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. **False**
3. A training program for employees under the age of 30 at the center would be expected to attract about 36 employees. **True**

**SOLUTION** mean *μ* = 38 Standard deviation *σ* =6

Emloyees older than 44 = 1-stats.norm.cdf(44,38,6)

= 0.1586

= 15.86%

= 63.4 employees

Employees between 38&44=

= stats.norm.cdf(44,38,6) – stats.norm.cdf(38,38,6)

= 0.3413

= 34.13%

= 136.52 employees

**Statement A is false**

Employees under the age of 30 = stats.norm.cdf(30,38,6)

= 0.0912

= 9.12%

= 36.48 employeesS

**Statement B is 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.

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| **SOLUTION we know that if X1∼ N(µ1, σ1^2 ), and X2 ∼ N(µ2, σ2^2 ) are two independent random variables then X1+ X2 =N(µ1 + µ2, σ1^2 + σ2^2 ) , and X − Y = N(µ1 − µ2, σ1^2 + σ2^2** |
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| **Therefore in the question** |
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| **2X1~ N(2 u,4 σ^2) and** |
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| **X1+X2 ~ N(µ 1+ µ2, σ^2 + σ^2 ) ~ N(2 u, 2σ^2 )** |
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**2X1-(X1+X2) = N( 4µ,6 σ^2)**

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 (stats.norm.interval(0.99,100,20))**
6. 90.1, 109.9
7. Consider a 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. company Assume that $1 = Rs. 45
8. Specify a Rupee range (centered on the mean) such that it contains 95% probability for the annual profit of the company.

SOL= Profit1=N(225,135) (in rupees)

Profit2=N(315,180) (in rupees)

Total Profit= Profit1+Profit2

=N(540,315)

**Rupee range (centered on the mean) that contains 95% probability for the annual profit of the company= stats.norm.interval(0.95,540,315) =(-77.38865513011706, 1157.388655130117)**

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

**SOLUTION=** (**520.2473649478876, 559.7526350521124**)

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

**SOLUTION= Profit2 has**  **a larger probability of making a loss as it has high variance.**