**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

**Given:**

**Mean = 4 5**

**Std Dev = 8**

**N=50**

**Therefore, probability that the car will not be ready within one hour from drop**

**From scipy import stats**

**(1-stats.norm.cdf(50,45,8) ) = 0.2659**

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.

**Z-score for age 44 = (44-38)/6 = 1 = 0.8413 = 84.13%**

**Employees above age 44 = 100-84.13 = 15.87% (63 out of 400)**

**Z-score for age 38 = (38-38)/6 = 0 = 0.50 = 50%**

**Employees between age 38 to 40 = 84.13-50.00 = 34.13% (136 out of 400)**

**Therefore the statement above is FALSE, since more number of employees are between age 38 to 44**

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

**Z-score for age 30 = (30-38)/6 = -1.33 = 0.0918 = 9.18% (36 out 400)**

**Hence, the above statement 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.

**X1 = N(μ, σ2)**

**2X1 = N(2 μ ,4 σ2)**

**X1 + X2 = N(μ+ μ , σ2+ σ2) = N(2 μ , 2 σ2)**

**Therefore,**

**2X1 – (X1+X2) = N(2μ-2μ , 4σ2+2σ2) = N(0 , 6σ2)**

**The mean for both the 2X1 and X1+X2 are the same, but the variance are different 4σ2and 2σ2respectively.**

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

**PYTHON FILE**

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.
3. Specify the 5th percentile of profit (in Rupees) for the company
4. Which of the two divisions has a larger probability of making a loss in a given year?

**PYTHON FILE**