**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?

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

1. 0.3875
2. 0.2676
3. 0.5
4. 0.6987
5. 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.
6. More employees at the processing center are older than 44 than between 38 and 44.

False, because as the data is normally distributed, majority of the data located at one *σ 38+6 or 38-6*

People above 44age =100-84.13 = 15.87% ≈ 63

People between 38 and 44 age=34.13% ≈ 137

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

True, expected employees= p(x<30)\*400 ≈ 36

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.

If two random variables follow normal distributions, then sum of the two random variables also follow normal distribution

2X1= N (2µ, σ^2) =N (2 u, 4σ^2)

X1+X2= N (µ + µ, σ^2 + σ^2) =N (2 u, 2σ^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.

Mean =100

SD=20

For 99% probability, we should leave 0.5% left and 0.5% right on normal curve,

So the Z score at extremes are:

stats.norm.ppf(0.005) gives Z-score of -2.575

stats.norm.ppf(0.995) gives Z-score of 2.575

The corresponding x values using Z=(x- µ)/σ the a and b values are(48.5, 151.5)

1. 90.5, 105.9
2. 80.2, 119.8
3. 22, 78
4. 48.5, 151.5
5. 90.1, 109.9
6. 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
7. Specify a Rupee range (centered on the mean) such that it contains 95% probability for the annual profit of the company.
8. Specify the 5th percentile of profit (in Rupees) for the company
9. Which of the two divisions has a larger probability of making a loss in a given year?

Mean= (5+7) \*45=540

SD= sqrt(9+16)\*45=225

stats**.**norm**.**interval(0.95,540,225)=(99.008, 980.9918)

X**=** 540**+**(**-**1.645) **\***(225)=169.875

stats**.**norm**.**cdf(0,5,3) = 0.0477

stats**.**norm**.**cdf(0,7,4) = 0.04