**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 stats.norm.sf(60,55,8)
3. 0.2676



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

False, because the probability of employee’s whose age is greater than 44 is less than the probability of people having age group between 38 and 44.

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

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.

2X1~ N (2µ, (2σ)2) ~ N(2µ,4σ2)

X1+X2 ~ N (µ+µ, σ2+σ2) ~ N(2µ,2σ2).

The means of both 2X1 & 2X2 are same but the standard deviation of 2X1 is double the standard deviation of X1+X2.

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 interval=stats.norm.interval(0.99,100,20)
3. 80.2, 119.8 np.round(interval,1)
4. 22, 78
5. 48.5, 151.5



1. 90.1, 109.9
2. 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

Combined mean = 5+7 = $12 million = (12\*45)/10 = Rs. 54 Crores

Combined standard deviation = √ (32 + 42 ) = $5 million = (5\*45)/10 = Rs. 22.5 Crores

1. Specify a Rupee range (centered on the mean) such that it contains 95% probability for the annual profit of the company.

in1, in2 = np.range(stats.norm.interval(0.95,54,22.5),2) #in million $

in1\_r, in2\_r = (in1\*45)/10, (in2\*45)/10 # in crore rupees

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

(((stats.norm.ppf(0.05)\*22.5)+54)\*45)/10 # in crore rupees

(stats.norm.ppf(0.05)\*22.5)+54 # in million dollars

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

1st division = stats.norm.cdf (0,5,3) = 0.0477903522728147

2nd division = stats.norm.cdf (0,7,4) = 0.040059156863817086

Therefore, division one has larger probability in making loss.