**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
6. 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.
7. More employees at the processing center are older than 44 than between 38 and 44. **False, the probability of employee age older than 44 yrs is 0.16 while probability of employee age between 38 and 44 yrs is 0.34**
8. A training program for employees under the age of 30 at the center would be expected to attract about 36 employees. **True, probability of employee age as 30 is 0.91, hence expected value 0.091\*400=36**
9. 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.

**In both distribution, 2X1 and X1+X2, the data will be normally 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
7. 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
8. Specify a Rupee range (centered on the mean) such that it contains 95% probability for the annual profit of the company.
9. Specify the 5th percentile of profit (in Rupees) for the company
10. Which of the two divisions has a larger probability of making a loss in a given year?

import numpy as np

from SciPy. Stats import norm

Mean = 5+7

print ('Mean Profit is Rs', Mean\*45,'Million')

->Mean Profit is Rs 540 Million

std\_dev= np.sqrt((9)+(16))

print('Standard Deviation is Rs', std\_dev\*45, 'Million')

->Standard Deviation is Rs 225.0 Million

Q5 A) print('Range is Rs',(stats.norm.interval(0.95,loc=540,scale=225)),'in Millions')

->Range is Rs (99.00810347848784, 980.9918965215122) in Millions

Q5 B) X= 540+(-1.645) \*(225)

print('5th percentile of profit (in Million Rupees) is', np.round(X,1))

->5th percentile of profit (in Million Rupees) is 170.0

Q5 C) stats.norm.cdf(0,5,3)->0.0477903522728147

stats.norm.cdf(0,7,4)->0.040059156863817086

Hence, Prob of Div 1 making a loss in a given year is higher than Prob of Div 2 making a loss in that year