**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

**ANS: Given mew is 45mins but it service of the car starts after 10 mins so new mew will be 55minutes and std=8. The probability that service manager cannot meet his commitment of getting the car ready in 1 hour is: by using formula, 1-stats.norm.cdf(60,55,8)=0.267**

**Option: B**

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.

**Ans: FALSE.Z=(44-38)/6=1=0.1587(by std nrml dist calc) by formula[x-mean/sd]**

**For the interval between 38 and 44**

**Z1=38-38/6=0; Z2=44-38/6=1**

**The proportion between 38 and 44 is diff between area under curve of Z1 and Z2.**

**P(38<=x<=44)=P(Z1<=Z<=Z2)**

**=0.3413**

**Therefore,the proportion X>44 is 0.1587 and between 38 and 44 is 0.3413.**

**As, proportion of 38-44 is greater than X>44 ,So given statement is False.**

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

**Ans: a) Employees under age 30=stats.norm.cdf(30,38,6)=0.09121**

**b)total no of employees=400(X<30)**

**=400\*0.09121=36.48. Therefore, given 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.

**As we know, X=N(mu1,sd1^2);Y=N(mu2,sd2^2)**

**So X+Y and X-Y=N(mu1+mu2,sd1^2+sd2^2), (mu1-mu2,sd1^2+sd2^2),respectively**

**Z=aX+bY i.e=linear combination**

**Thus,2X1=N(2mu,4sd^2)**

**(X1+X2)=N(mu+mu,sd^2+sd^2**

**Therefore,diff=(4mu,6sd^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
6. 90.1, 109.9

Ans=0.99=x,mean=100,sd=20

By **np.round(stats.norm.interval(0.99,100,20)):=[48.5 151.5]**

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

**ANS:Mean=M1+M2 i.e5+7;12 Therefore, mean profit=Mean\*45=540**

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

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

Ans:**stats.norm.interval(0.95,540,225)**

**Ans** 99.00810347848784, 980.9918965215122

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

(5th percentile=-1.645)

Ans**:X=540+(-1.645)\*(225)=169.875 round up**=**170**

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

Ans:**For division1: stats.norm.cdf(0,5,3)=0.04779**

**For division2:stats.norm.cdf(0,7,4)=0.04005**