**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: B 0.2676**

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.

**False: since the probability of NO. of employee having age between 38 to 44 is 0.3413 which is higher than probability of No, of employees having age more than 44 is 0.1586 .**

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

**Probability of employees under age of 30 is 0.091211**

**(stats.norm.cdf(30,loc= 38, scale=6))**

**Therefore E(x)= 400\*0.09=36**

**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.
2. 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.
3. 90.5, 105.9
4. 80.2, 119.8
5. 22, 78
6. 48.5, 151.5
7. 90.1, 109.9

**stats.norm.interval(0.99, loc=100, scale=20)**

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

**Mean for both company=5+7=$12 million**

**Profit=$12 million**

**Mean Profit in rupee=12\*45=540 million rupee………………………………(a)**

**Sd for both sqrt(3^2+4^2)=sqrt(9+16)=5^2**

**Sd for both company in rupee= 45\*5=225 million rupee**

**For 95% probability mean= 540 sd=225**

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

**=** **(99.00810347848784, 980.9918965215122)**

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

Formula for percentile

**For 5th percentile Z=-1.6448536269514729**

**= X=μ + Zσ**

**=540 +(-1.644)\*225**

**=170.1 million**

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

For

Profit1 ~ N(5, 32) probability for lo ss is **0.0477**

**For**

Profit2 ~ N(7, 42) probability for loss is **0.040**

Ans= company with Profit1 ~ N(5, 32) make more loss