**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

**Answer: Since work being 10 min after the car is dropped, the time left to**

**complete work 50 mins, Probability that Service Manager cannot meet his**

**commitment=P(X&gt;50)=1-Pr(x&lt;=50)**

**Convert 50 to z-score**

**Standard normal variable Z=(X-µ)/σ=(x-45)/8**

**P(X&lt;=50)=P(Z&lt;=(50-45)/8)=PR(Z&lt;=0.625) =0.73237= 73.237%**

**Probability that service manager will not meet his commitment**

**is 100-73.237=26.763%=0.2676**

**The answer 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**

**Around 70% of the data falls within one standard deviation of the mean (µ+= 38+6=44)**

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

**ANS: True**

**Z=(X-µ)/ σ**

**P(X≤30)=p(Z≤(30-38)/6)=p(Z≤-1.33)= 0.0918(using z table)**

**Expected count=0.0918\*400= 36.72**

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.

**ANS: 2 X1 will be greater scale version than X1 + X2 . If X1 and X2 are normally distributed then the sum of the random sample will be exactly same**

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: D**

**The probability of getting value between a &amp;b is 0.99**

**So, the probability of getting value outside a &amp;b is 1-0.99=0.01**

**The probability towards left of a =-0.01/2=-0.05**

**The probability towards right of b= 0.01/2=0.05**

**By finding Standard Normal Variable(z), need to calculate X.**

**Z\*σ+µ=x**

**-(-2.57)\*20+100=151.4**

**(-2.57)\*20+100=48.6**

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.
3. Specify the 5th percentile of profit (in Rupees) for the company
4. Which of the two divisions has a larger probability of making a loss in a given year?

**ANS:- Mean profit is Rs 540 million and standard Deviation is Rs 225.0 million**

**A. Ans is 90.990**

**B. To compute 5 th percentile ,we use the formula X = μ + Zσ; wherein**

**from z table, 5 th percntile = -1.645 X= 540+(-1.645) \* (225)**

**Therefore, 5th percentile of profit (in Million) is 202.05 millions**

**C.Using stats.norm.cdf(0,5,3) Probability of division 1 making a loss P(X&amp;lt;0)**

**is 0.04780 and stats.norm.cdf(7,4) probability of division 2 making a loss P(X&amp;lt;0)**

**is 0.04005.**