**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**

**As the work begins 10min after the car is dropped the manager has 50mins to complete the serving**

**Probability of manager not meeting his commitment 1 - (P>50)**

**Z = (50 - 45)/8 = 5/8 =0.625**

**Pr(Z<=0.625) = 0.74 = 1 - 0.74 = 0.26**

**So the correct option is 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.**
3. **A training program for employees under the age of 30 at the center would be expected to attract about 36 employees.**

**Z for 44 = (44-38)/6 = 1 = P(Z<=1) = 0.8413 =84.13%**

**Probability of employees greater than 44 = 100 -84.13 = 15.86%**

**= 63 people out of 400**

**Probability of employees between 38 and 44**

**P(38<=X<=44) = P(X<44) - P(x<38)**

**P(X<38) = 38-38/6 = 0 = P(Z<=0) = 0.5 = 50%**

**P(X<44) - P(x<38) = 84.13 - 50 = 34.13% = 137 people out of 400**

**As more number of people are between 38 and 44 the statement is false.**

1. **P(X<30)**

**Z = (30 - 38)/6 = -1.33**

**P(Z<=-1.33) = 0.0918 = 9.18% = 36.72 people therefore the 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.**

**2 is simply a larger scale version of the random variable X 1. If is normally distributed**

**then 2X1 is also normally distributed.**

**X 1 and X 2 are normal distributed, the associated sums and random samples are exactly (and not**

**just approximately) normal, with the appropriate parameters.**

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**

**Probability of random variable is 0.99**

**Probability of going outside of a and b is 0.01**

**The Probability towards left from a = -0.01/2 = -0.005**

**The Probability towards right from b = 0.01/2 = 0.005**

**Z(-0.005)\*20+100 = -(-2.57)\*20+100 = 151.4**

**Z(+0.005)\*20+100 = (-2.57)\*20+100 = 48.6**

**Option D is correct**

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?**
5. **Mean = mean1(5) + mean2 (7) = 12\*45 = 540 million**

**Variance = var1(9) + var2(16) = 25**

**Sd = square root of 25 = 5 \* 45 =225**

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

**= (99.00810347848784, 980.9918965215122)**

**B.**

**Z of 5th percentile is -1.645**

**Z = (X-μ)/σ**

**X = μ + Zσ**

**540+(-1.645)\*(225) = 170**

**C.stats.norm.cdf(0,5,3)#probability is 0.0477903522728147**

**stats.norm.cdf(0,7,4)#probability is 0.040059156863817086**

**Probability of division 1 making a loss is greater than division 2.**