PES University, Bangalore

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UE19CS203 – STATISTICS FOR DATA SCIENCE

Unit - 3 - Probability Distributions

QUESTION BANK

Continuity Correction

Exercises for Section 4.11

[Text Book Exercise – Section 4.11 – Q. No. [1 – 20] – Pg. No. [300 - 302]]

1. Among all the income-tax forms filed in a certain year, the mean tax paid was $2000 and the standard deviation was $500. In addition, for 10% of the forms, the tax paid was greater than $3000. A random sample of 625 tax forms is drawn.
    a) What is the probability that the average tax paid on the sample forms is greater than $1980?
    b) What is the probability that more than 60 of the sampled forms have a tax of greater than $3000?

2. Bags checked for a certain airline flight have a mean weight of 15 kg with a standard deviation of 5 kg. A random sample of 60 bags is drawn.
    a) What is the probability that the sample mean weight is less than 14 kg?
    b) Find the 70th percentile of the sample mean weights.
    c) How many bags must be sampled so that the probability is 0.01 that the sample mean weight is less than 14 kg?

3. The time spent by a customer at a checkout counter has mean 4 minutes and standard deviation 2 minutes.
    a) What is the probability that the total time taken by a random sample of 50 customers is less than 180 minutes?
    b) Find the 30th percentile of the total time taken by 50 customers.

4. Among the adults in a large city, 30% have a college degree. A simple random sample of 100 adults is chosen. What is the probability that more than 35 of them have a college degree?

5. In a process that manufactures bearings, 90% of the bearings meet a thickness specification. A shipment contains 500 bearings. A shipment is acceptable if at least 440 of the 500 bearings meet the specification. Assume that each shipment contains a random sample of bearings.
    a) What is the probability that a given shipment is acceptable?
    b) What is the probability that more than 285 out of 300 shipments are acceptable?
    c) What proportion of bearings must meet the specification in order that 99% of the shipments are acceptable?

6. A machine produces 1000 steel O-rings per day. Each ring has probability 0.9 of meeting a thickness specification.
    a) What is the probability that on a given day, fewer than 890 O-rings meet the specification?
    b) Find the 60th percentile of the number of O-rings that meet the specification.
    c) If the machine operates for five days, what is the probability that fewer than 890 O-rings meet the specification on three or more of those days?

7. The concentration of particles in a suspension is 30 per mL.
    a) What is the probability that a 2 mL sample will contain more than 50 particles?
    b) Ten 2 mL samples are drawn. What is the probability that at least 9 of them contain more than 50 particles?
    c) One hundred 2 mL samples are drawn. What is the probability that at least 90 of them contain more than 50 particles?

8. A new process has been designed to make ceramic tiles. The goal is to have no more than 5% of the tiles be nonconforming due to surface defects. A random sample of 1000 tiles are inspected. Let X be the number of nonconforming tiles in the sample.
    a) If 5% of the tiles produced are nonconforming, what is $P(X \geq 75)$?
    b) Based on the answer to part (a), if 5% of the tiles are nonconforming, is 75 nonconforming tiles out of 1000 an unusually large number?
    c) If 75 of the sample tiles were nonconforming, would it be plausible that the goal had been reached? Explain.
    d) If 5% of the tiles produced are nonconforming, what is $P(X \geq 53)$?
    e) Based on the answer to part (d), if 5% of the tiles are nonconforming, is 53 nonconforming tiles out of 1000 an unusually large number?
    f) If 53 of the sample tiles were nonconforming, would it be plausible that the goal had been reached? Explain.