

Chapter 8 Exam Prep Worksheet: The Binomial Distribution

1. **Multiple Choice:** Roger Federer achieved a career-high first serve percentage of 65.0% during the 2019 ATP season. If we assume that each of his first-serve attempts is independent, we can model a match where he attempts 80 first serves as a Binomial experiment.

Which line of code below would find the probability that he successfully lands at least 55 of those first serves?

- A. `pbinom(q = 55, size = 80, prob = 0.65, lower.tail = FALSE)`
- B. `pnorm(q = 54, size = 80, prob = 0.65, lower.tail = FALSE)`
- C. `pbinom(q = 55, size = 80, prob = 0.65, lower.tail = TRUE)`
- D. `pbinom(q = 54, size = 80, prob = 0.65, lower.tail = FALSE)`

Bill the Statypus says: Remember, “at least 55” means 55 is a success! Since `pbinom` with `lower.tail = FALSE` calculates strictly *greater than* q , what number do you need to plug in so that 55 is included in the upper tail?

Sally the Statypus says: Don’t be fooled by option B! Just like in Chapter 7, always check that you are using the correct distribution engine (`pbinom` vs `pnorm`).

2. **Model Diagnosis:** A quality control inspector at a large chocolate factory is evaluating the daily production of truffles. Decide if each scenario can be modeled as a Binomial experiment? Justify your answer based on the requirements for a Binomial distribution.
- (a) **Scenario 1:** The inspector selects a random batch of exactly 20 truffles from the day’s production and counts how many have cracked coatings. Assuming the daily defect rate is constant at 3%.
 - (b) **Scenario 2:** The inspector decides to pull truffles off the assembly line one by one *until* they find the first one with a cracked coating.

Bill the Statypus says: I don’t feel like wasting paper typing more here, look over the “Counting is Hard” worksheet to get some help here.

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Sally the Statypus says: Why do people do this?!?