Bookmarks

- Module 1: The Basics of R and Introduction to the Course
- Entrance Survey
- Module 2: Fundamentals of Probability, Random Variables, Distributions, and Joint Distributions
- Module 3: Gathering and Collecting Data, Ethics, and Kernel Density Estimates
- Module 4: Joint, Marginal, and Conditional Distributions & Functions of Random Variable

An Example: Unconditional Expectation and Variance - Quiz

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Use the following information for each of the following questions: Suppose that you are the swim coach for athletes that will be going to the Olympic Games to compete in swimming. Your athletes must swim in the heats and place highly enough or swim a fast enough time to make it through to the final race. Suppose that the probability of making the final race, p_F, is 0.4 or 40% for each athlete and each athlete's outcome is independent.

Question 1

1/1 point (graded)

Using the same set up as in the previous question (recopied above for convenience), suppose that the team size N is now a random variable with expectation 2 and variance 1.5. What is the expectation of the number of swimmers that make it to the final?

Please round your answers to 2 decimal places (e.g. if you obtain 0.443, round to 0.44 and if you obtain 0.445, round to 0.45).

0.8 ✔ **Answer:** 0.80

0.8

Explanation
Using the law of iterated expectations,

$$E[F] = E[E[F|N]] = E[Np_F] = p_F E[N] = 0.4 * E[N] = 0.4 * 2 = 0.8$$

Submit You have used 1 of 2 attempts

✔ Correct (1/1 point)

Question 2

1/1 point (graded)
What is the variance of the number of swimmers that make it to the final?

Please round your answers to 2 decimal places (e.g. if you obtain 0.443, round to 0.44 and if you obtain 0.445, round to 0.45).

0.72 ✔ **Answer:** 0.72

0.72

Explanation
Using the law of total variance:

$$Var(F) = Var(E[F|N]) + E[Var(F|N)] = Var(Np_F) + E[Np_F(1-p_F)] =$$

$$p_F{}^2 Var(N) + p_F * (1 - p_F) * E(N) = 0.4^2 * 1.5 + 0.4 * 0.6 * 2 = 0.72$$

Submit You have used 1 of 2 attempts

✔ Correct (1/1 point)

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