MAS 170 Elementary Statistics Spring 2020
Exam 3 (Ch 13--18) Solutions

Questions 1 and 2.

P(Red shows 4 AND Blue shows 1)
= P(Red shows 4)*P(Blue shows 1) (multiplication rule for independent events)
= 1/6 * 1/6

Question 3.

P(one die shows 4 and other shows 1)
= P([R is 4 and B is 1] OR [R is 1 and B is 4]) (rephrasing)
= P(R is 4 and B is 1) + P(R is 1 and B is 4) (addition rule)
= 1/6 * 1/6 + 1/6 * 1/6 (same work as Questions 1 and 2)
= (approx) 5.56%

Questions 4 and 5.

Method 1.

P(total is 5)
= P([one is 4 and other is 1] OR [one is 2 and other is 3])
(rephrasing)
= P(one is 4 and other is 1) + P(one is 2 and other is 3)
(addition rule)
= 2 * (answer to question 3) (same reasoning as Question 3)
= 4/36

Method 2.

Using the 6 by 6 chart of all 36 equally likely dice rolls (like in the textbook), we can see all four possible rolls that produce a total sum of 5 spots, namely, the rolls (4,1), (3,2), (2,3), and (1,4). So the P(total is 5) = 4/36.

Question 6.

We have P(E) = 4/36 = 1/9 (by Questions 4 and 5), but P(E|F) = P(E is 1) = 1/6. Since 1/9 does not equal 1/6, we conclude that E,F are dependent.

Question 7.

Using the binomial formula with n=18, k=3, and p=1/6, the desired probability is

(18 choose 3) * (1/6)^3 * (5/6)^(15)
= 816 * 5^(15) / 6^(18)
= (approx) 24.52%

which rounds to 25% (to the nearest percent).

Question 8.

We expect to get a 4 on 1 out of 6 rolls of a fair die, which is

1/6 = (approx) 16.67% of the time.

To get 20% or more 4's, we desire a high relative error. The Law of Averages says that relative error goes down as the number of rolls goes up, so we have a better chance of winning with 200 rolls.

Questions 9 and 10.

The box model has 6 tickets: 1 ticket is a 1 and 5 tickets are 0s. We calculate the necessary numbers.

ave(box) = 1/6 = (approx) .167
SD(box) = sqrt(5)/6 = (approx) .373
expected(sum) = 1/6 * 200 = approx 33.33
SE(sum) = sqrt(5)/6 * sqrt(200) = approx 5.27
z = (40 - expected(sum)) / SE(sum) = approx 1.27
P = (approx) (100 - 80)/2 = 10%

Questions 11 and 12.

The box model has 6 tickets: 1 ticket is a +$3, and 5 tickets are -$1. Here are the calculations.

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ave(box) = -1/3 = (approx) -.33
SD(box) = 4 * sqrt(1/6 * 5/6) = approx 1.49
expected(sum) = -1/3 * 200 = (approx) -$66.67
SE(sum) = 2/3 * sqrt(5) *sqrt(200) = (approx) $21.08
z = (approx) (-20 - (-66.67)) / 21.08 = (approx) 2.21
P = (approx) (50 + 1/2 * 97.3) = 98.7%
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The last number rounds to 99% (to the nearest percent).

Questions 13 and 14.

The box model has 6 tickets, labeled 1,2,3,4,5,6.

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ave(box) = 3.5
SD(box) = sqrt((2.5^2 + 1.5^2 + .5^2)/3) = (approx) 1.71
expected(sum) = 3.5 * 200 = 700
SE(sum) = (approx) 1.71*sqrt(200) = (approx) 24.2
z = (approx) 20/24.2 = (approx) .83
P = (approx) 59%
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