Math 186 HW #4 Solutions

**7.8**

**a.** Yes.

**b.** Yes.

**c.** Yes.

**d.** No. A probability cannot be greater than 1.

**e.** No. A probability cannot be negative.

**7.14**

**a.** The probability of a 6 = 1/6.

**b.** The probability of a 1 or 2 is 2/6 = 1/3.

**c.** The probability of an even number is the probability of a 2, 4, or 6. This probability = 3/6 =1/2.

**7.18**John's reasoning is not correct. In the long run, if he repeatedly plays the lottery, the proportion of times he would win is 1/1000. This does not mean that he will definitely win once every 1000 times he tries.

**7.20  a.** BY, BS, BA, YS, YA, SA. **b.** 1/6.

**7.24**

**a.** Yes. The outcome for one coin does not affect the probabilities for the other coin.

**b.** No. The outcomes for the two coins apply to separate random circumstances (the outcome for each coin is one random circumstance) and complementary events are defined only for the same random circumstance.

**c.** No. A particular outcome of the nickel, for instance, doesn’t exclude any outcome of the penny from occurring when both coins are flipped.

**7.30**

**a.** They are not independent and they are not mutually exclusive. If the dice are known to sum to 4, the probability the red die is a 3 is affected because the red die could then not possibly be 4, 5, or 6, so the events are not independent. Both can happen in the same toss, so they are not mutually exclusive.

**b.** They are mutually exclusive because if the sum is 4, the red die alone cannot possibly be a 4. They are not independent – mutually exclusive events are never independent, because knowing one has occurred tells you that the probability of the other one has to be 0.

**7.32**

**a.** The approximate probability = 22/190 = .1158 that a randomly selected person will pick the number 3.

**b.** The approximate probability = (2+6)/190 = 8/190 = .0421 that a randomly selected person will pick either 1 or 10.

**c.** The approximate probability = (2+22+18+56+14)/190 = 112/190 = .5895 that a randomly selected person will pick an odd number.

**7.34**

A = event that a woman is between the ages of 20 and 24.

B = event that a woman is between the ages of 40 and 44.

C = event a woman can bear a child (i.e., is fertile). *P*(C|A) = .90. *P*(C|B) = .37.

**7.42**

**a.**P(A)=1⁄2.

**b.** P(B) = 1⁄2.

**c.** P(A and B) = (1⁄2)(1⁄2) = 1⁄4.

**d.** P(A or B) = P(A) + P(B) – P(A and B) = 1⁄2 + 1⁄2 − 1⁄4 = 3⁄4.

**7.48**

**a.** P(A) = .55; P(Ac) = .45; P(B|A) = .80; P(B|Ac) = .10.

**b.** P(A and B) = P(A)P(B|A) = (.55)(.80) = .44. This is the probability of being a Republican and voting for Candidate X.

**c.** P(Ac and B) = P(Ac) P(B|Ac) = (.45)(.10) = .045. This is the probability of being a non-Republican and voting for Candidate X.

**d.**P(B)=P(AandB)+P(Ac andB)=.485.

**e.** Candidate X received 48.5% of the votes.

**7.58**

**b.** *P*(red pickup truck *and* smokes *and* blond)= (1/50)(.30)(.20) = .0012. Use the multiplication rule for independent events (Rule 3b extension).

**c.** Number fitting the description of the criminal = 10,000(.0012) = 12. The value of the proportion (.0012) was determined in part (b).

**d.** Probability = 11/12 = .917 that the driver arrested by the police is innocent. There are 12 vehicle owners who fit the description. Assuming the description is accurate, one of these 12 is guilty and the other eleven are innocent.

**e.** The answer to part (d) suggests an argument against the prosecutor's reasoning. While the evidence narrows the possibilities down to only twelve people, eleven of these twelve people are innocent. Conditional on the given evidence (and only the given evidence), the probability is high (.917) that the arrested person is innocent.

**7.60**P(at least one large tip)=1−P(no large tips)=1−.755 = 1−.2373=.7627. Note that for any one table, the probability of *not* getting a large tip is .75, so the probability of *not* getting a large tip for any of five tables is .755.

**7.62**

**a.** (.6)(100) = 60.

**b.** In part (a) we found that there are 60 science majors in the class. Because 20% (or .2) of them are seniors, the total number of students who are science majors and seniors is (.2)(60) = 12. You could also solve this using Rule 3a: P(Science and Senior) = P(Science) × P(Senior | Science) = (.6)(.2) = .12, so the total number is .12 × 100 = 12 students.

**c.** If there are 100 students in the class the distribution by Major and Grade status would be as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| Major | Senior | Non-senior | Total |
| Science | 12 | 48 | 60 |
| LA | 12 | 28 | 40 |
| Total | 24 | 76 | 100 |

**d.** Out of the 100 students, 24 are seniors. So the proportion is 24/100 = .24. Therefore, 24% of the students are seniors.

**7.110**

**a.***P*(all three have Type O+)= .33\*.33\*.33 .037.  Use the multiplication rule for independent events (Rule 3b extension).

**b.***P*(none of the three have TypeO+)= 2/3 \* 2/3 \* 2/3  8/27 = .2963 Use the multiplication rule for independent events (Rule 3b extension).

**c.***P*(two have Type O+ and one does not)=3 \* 1/3 \* 1/3 \* 2/3 = 2/9 .2222  The multiplication by 3 is necessary because there are three different mutually exclusive ways for two persons to have Type O+ and one not to have Type O+. The person who is not Type O+ could be either the first person, or the second person, or the third person when the three adults are listed in the order they were selected.