## Lesson 3 - Homework

**Notes:**

* The answers to the problems will be posted on Sunday after the due date. To view the answers, click on the **Homework Solutions** link in the menu bar to the left.

**1.** Problem 4.11 of the 6th edition (which is Problem 4.6 of the 5th edition) hint: list out the events in A,B,C respectively, it is then easy to compute their probabilities.

**2.** For the events given in the above problem, compute:

1. P (A | B)
2. P (A | C)
3. P (B | C)
4. Are A, B independent? Are A, B mutually exclusive?
5. Are B, C independent? Are B,C mutually exclusive?

**3.** Consider the following outcomes for an experiment:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Outcome | 1 | 2 | 3 | 4 | 5 |
| Probability | .20 | .25 | .15 | .10 | .30 |

Let A consists of outcomes 1, 2, 4 and B consist of outcomes 4 and 5

a. Find P(A) and P(B)

b. Find P( both A and B occur)

c. Find P( either A or B occur)

d. Are A, B independent?

e. Are A, B mutually exclusive.

**4.** Problem 4.27 of the 6th edition which is Problem 4.21 of the 5th edition

**5.** Problem 4.28 of the 6th edition whichisProblem 4.22 of the 5th edition

**6.** Problem 4.41 of the 6th edition which is Problem 4.34 of the 5th edition

**7.** If the table in sample problem 2 is given as:

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Test** | **Result** |  |
| **True Status** | **(+)** | **(-)** | **Total** |
| **Pregnant** | 70 | 2 | 72 |
| **Not Pregnant** | 18 | 910 | 928 |
| **Total** | 88 | 912 | 1000 |

Give the probabilities asked in a, b, c, d of the sample question 2.

**Reading:** *An Introduction to Statistical Methods and Data Analysis*, chapters 4.1 - 4.4, 4.6, 4.7.

**Sample problem 1:**

**1. A die is to be rolled and we are to observe the number of that falls face up. Find the probabilities of these events:**

a. A : observe a 6

b. B : observe an even number

c. C : observe a number greater than 2

d. D: observe an even number and a number greater than 2

e. find P( A given B).

f. Are C, D independent?

g. Are C, D mutually exclusive?

**Solution to sample problem 1.**

**For this problem, the possible outcomes are: {1, 2, 3, 4, 5, 6}, points shown on the face of a die. If this is a fair die, then:**

1. first list out A: A = { 6 } , P(A) = 1/6
2. first list out B: B = { 2,4, 6 }, P(B) = 3/6= ½
3. since C = { 3,4,5,6 }, P(C) = 4/6 = 2/3
4. since D = { 4,6 }, P(D) = 2/6 = 1/3
5. P(A given B) = P( A intersect B)/P(B) = P( {6})/P(B) = (1/6)/(3/6) = 1/3
6. To check whether C, D are independent, we need to check whether

P(C intersects D) = P( C) \* P(D)?

C intersects D = {4, 6}, P(C intersects D) = 2/6

P( C) \* P(D) = (2/3) \* (1/3) = 2/9,

Since P(C intersects D) ≠ P( C) \* P(D) ,

C, D are not independent.

1. Mutually exclusive means there is nothing in common to C and D, since

C intersects D = {4, 6} , these two outcomes are in common to C and D, thus C, D are not mutually exclusive.

**Sample problem 2. Example on Conditional probability:** A female student wants to determine whether to PANIC or not about the positive result she received when performing a home pregnancy test.  To answer her question, she finds the following data on the accuracy of the pregnancy test she used when performed on 1,000 college-aged women.  

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Test** | **Result** |  |
| **True Status** | **(+)** | **(-)** | **Total** |
| **Pregnant** | 48 | 2 | 50 |
| **Not Pregnant** | 38 | 912 | 950 |
| **Total** | 86 | 914 | 1000 |

1. What percentage of the women in the sample of 1,000 women were pregnant?
2. What percentage of the women in the sample of 1,000 women tested positive?
3. Given a woman is pregnant, what is the probability that she gets a positive pregnancy test?
4. Given a woman receives a positive pregnancy test, what is the probability that she is truly pregnant?   
       
   **Solution to Sample problem 2**

a. What percentage of the women in the sample of 1,000 women were pregnant?

P( pregnant) = 50/1000 = 0.05

1. What percentage of the women in the sample of 1,000 women tested positive?

P( tested positive) = 86/1000 = 0.086

1. Given a woman is pregnant, what is the probability that she gets a positive pregnancy test?

P( test positive given pregnant)

= P(test positive and pregnant)/P(pregnant)

= (48/1000)/(50/1000) = 48/50 = 0.96

* 1. Given a women receives a positive pregnancy test, what is the probability that she is truly pregnant?   
         
     P(pregnant given test positive)

= P(pregnant and test positive)/P(test positive)

= (48/1000)/( 86/1000) = 0.558