**MAT1372 Solution to Review for exam #2**

Notation: **P(A ∪ B) means P(A or B); P(A ∩ B) means P(A and B)**

Addition rule of probability: **P(A ∪ B) = P(A) + P(B) – P(A ∩ B)**

Multiplication rule of probability for independent events A and B: **P(A ∩ B) = P(A)\*P(B)**

Multiplication rule of probability for dependent events (conditional probability):

 **P(A ∩ B) = P(A)\*P(B|A)**

For questions 1 and 2, first determine whether to use the **multiplication rule** or the **addition rule** of probability. Then find the probability using the corresponding formula.

1. A bag contains 12 balls each has one of the numbers 1, 2, 3, …, 12 written on it.
2. If **one** ball is selected at random, what is the probability that the ball has a number that is even or less than or equal to 6 ?

Answer: 3/4

1. **Two** balls are selected at random **without** replacement. What is the probability that they both have even numbers on them?

Answer: 5/22

Definition 1: Two events A and B are disjoint if **P(A ∩ B)=∅**

Definition 2: Two events A and B are independent if **P(A ∩ B) = P(A)\*P(B)**

1. a) If P(A)= 0.3 and P(B) = 0.6, and events A and B are independent, find P(A **∩** B) Answer: 0.18
2. If P(A)= 0.3 and P(B) = 0.6, and events A and B are disjoint, find P(A **∪** B) Answer: 0.9
3. If P(A)= 0.3 and P(B) = 0.6, and P(A **∩** B) = 0.2, find P(A ∪ B) Answer: 0.7
4. Page 160 #11
5. Draw a Venn diagram which represents the situation in #11
6. Find the probability that the picnic will be postponed. Answer: 0.7
7. Find the probability that the picnic will not be postponed. Answer: 0.3

4. Page 205 #21

 a) 248/500

 b) 54/252

 c) 36/248

 d) In order for A and B to be independent, they must satisfy: **P(A ∩ B) = P(A)\*P(B)**

 ** and , thus, not independent**

**General Formula for Expected Value and Variance:**

  

1. Let X be a random variable with p(x) given in the following table.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| X | 1 | 2 | 3 | 4 |
| p(x) | 0.4 | 0.3 | ? | 0.1 |

1. Find p(3). Answer: p(3) = 0.2
2. Find  Answer: 
3.  Answer: 
4. Page 236 #8 Answer: a)  b) 

|  |  |
| --- | --- |
| x | P(x) |
| 1 | 12/60 |
| 2 | 25/60 |
| 3 | 16/60 |
| 4 | 7/60 |

**The Binomial Probability Distribution:**

X=number of successes in *n* trials Possible values for X: {0, 1, 2, …, n}

 

 

**\*EXCEL command: BINOMDIST (i, n, p, true/false for cumulative)**

**The Poisson Probability Distribution: Poisson (λ)**

X=number of occurrences in an interval Possible values for X: {0, 1, 2, … }

   

**\*EXCEL command: POISSON (i, mean, true/false for cumulative)**

1. Research has shown that 30% of all persons afflicted by a certain illness will recover. Research has also shown that if 10 people with the illness are randomly selected and received a particular medication, 9 people recovered shortly thereafter. Let X be the random variable which represents the number of people recovered from the illness.
2. What are the possible values for X. Answer: X=0,1,2,3,…10
3. What is the assumed distribution? What is (are) the parameter(s)?

Answer: Binomial, 

1. Show by probability why you think the medication is (or isn’t) effective.

Answer:  or binom.dist(9,10,0.3,false). The medication must be effective, because the probability that 9 people will recover without the medication is very small.

1. What is the expected value of recovery if no medication is administered?

Answer: 

1. Find the variance. Answer: 
2. Suppose an airline company finds that 10% of the people who make reservations do not show up (90% do show up). The airline sells 140 tickets for a flight with 125 seats. What is the probability that the airline company needs to offer refunds (if more than 125 people show up?)

Answer: =1- binom.dist(125, 140, 0.9, true)=0.57053

You will receive on average two telemarketing phone calls in one day. Let X be the number of telemarketing phone calls you receive in one day.

1. What are the possible values for X? Answer: X=0,1,2,3,…
2. What is the assumed distribution? What is (are) the parameter(s)? Answer: Poisson, 
3. What is the probability that you will receive 1 telemarketing phone call?

Answer:=poisson (1, 2, false) = 0.270670566

1. What is the expected value for the number of phone calls you receive? Answer: 
2. The mean number of cars arriving at a toll booth is 80 cars per hour. The attendant makes a one-minute phone call. Let X be the random variable which represents the number of cars arriving at the toll booth during the one-minute phone call.
3. What are the possible values for X? Answer: X=0,1,2,3…
4. What is the assumed distribution? What is (are) the parameter(s)? Answer: Poisson, 
5. What is the probability that **at least** 1 car arrives during the call?

Answer: =1- Poisson(0, 80/60, true)= 0.736402862

1. What is the expected value for the number of cars arriving per minute?

Answer: 