

## MATHEMATICS 360-255-LW

Quantitative Methods II

Martin Huard

Fall 2009

### IV – Discrete Probability Distributions

1. Let  $x$  denote the number of auto accidents that occur in a city during a week. The following lists the probability distribution of  $x$ .

$x$	0	1	2	3	4	5	6
$p_x$	0.12	0.16	0.22	0.18	0.14	0.12	0.06

Determine the probability that the number of auto accidents that will occur during a given week in this city is

- exactly 4
  - at least 3
  - less than 3
  - 3 to 5 (inclusively)
2. Here is the probability distribution for the number of candy bars sold at a house by a child selling the candy for a school fundraiser.

$x$	0	1	2	3
$p_x$	0.4	0.25	0.2	0.15

- Find the probability that the child fails to sell a candy bar at a particular house.
  - Find the probability that the child sells at least 2 candy bars at a particular house.
  - How many candy bars should the child expect to sell at a house?
  - Find the standard deviation of this probability distribution.
  - Draw a histogram for this probability distribution.
3. According to a survey, 60% of all students at a large university suffer from math anxiety. Two students are randomly selected from this university. Let  $x$  denote the number of students in this sample who suffer from math anxiety.
- Find the probability distribution for  $x$ .
  - Draw a histogram of the probability distribution.
  - Find the mean of this probability distribution.
  - Find the variance for this probability distribution.
4. An urn contains 20 marbles, of which 8 are blue and 12 are green. Three marbles are taken out of the bag and the number of blue marbles is counted.
- Construct a probability distribution.
  - Draw a histogram.
  - Find the mean of this probability distribution.
  - Find the standard deviation of this distribution.

5. A consume agency surveyed all 2500 families living in a small town to collect data on the number of television sets owned by them. The following table lists the frequency distribution of the data collected by this agency.

Number of TV sets owned	0	1	2	3	4
Number of families	120	970	730	410	270

- Construct a probability distribution table for the number of television sets owned by these families.
  - Draw a histogram.
  - Find  $P(x > 2)$
  - Find  $P(x \leq 1)$
  - Find  $P(1 \leq x \leq 2)$
  - How many TV sets do you expect a family chosen at random to have?
  - Find the standard deviation of this distribution.
6. A lottery has a first prize of \$5000, two second prizes of \$1000 each, and two \$100 third prizes. A total of 10000 tickets are sold, at \$1 each. Find the expected winnings of a person buying 1 ticket.
7. In one form of the game *Keno*, the house has a pot containing 80 balls, each marked with a different number from 1 to 80. You buy a ticket for \$1 and mark one of the 80 numbers on it. The house then selects 20 numbers at random. If your number is among the 20, you get \$3.20. Find the expected winnings for a person buying one ticket.
8. In Super 7, a selection is composed of 7 different numbers from 1 to 47. Prizes can be won in seven different categories: 7/7, 6/7+, 6/7, 5/7, 4/7, 3/7+ and 3/7. To win, a single selection must contain 3, 4, 5, 6 or 7 numbers that match the winning selection. The bonus number, represented by the "+" symbol, is associated only with the categories 6/7+ and 3/7+. To win in these categories, a single selection must contain respectively, in addition to the bonus number, 6 or 3 numbers that match the winning selection. Tickets are sold \$2 and you get three selections. Here are the prizes.

Category	Prize
7/7	\$7,022,522*
6/7+ bonus	\$68,713*
6/7	\$1,762*
5/7	\$100*
4/7	\$10
3/7+ bonus	\$10
3/7	Free ticket

\* average prize

- What is the probability of winning the Jackpot?
- What is the probability of winning?
- What is the payoff rate?

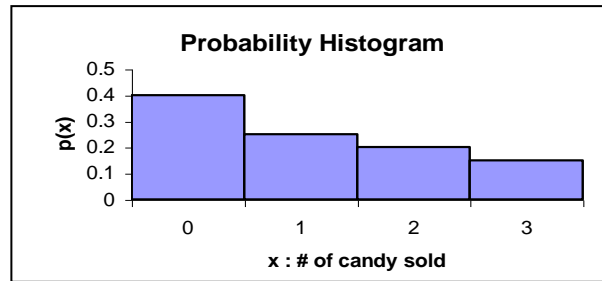
**ANSWERS**

1. a) 0.14  
 2. a) 0.4  
 b) 0.35  
 c) 1.1  
 d) 1.09

b) 0.5

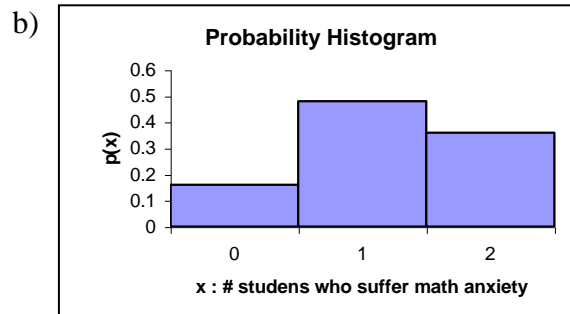
c) 0.5

d) 0.44



3. a)

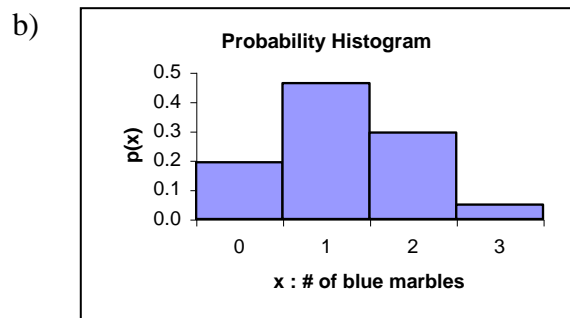
Probability Distribution	
$x$	$p_x$
0	0.16
1	0.48
2	0.36



- c) 1.2  
 d) 0.48

4. a)

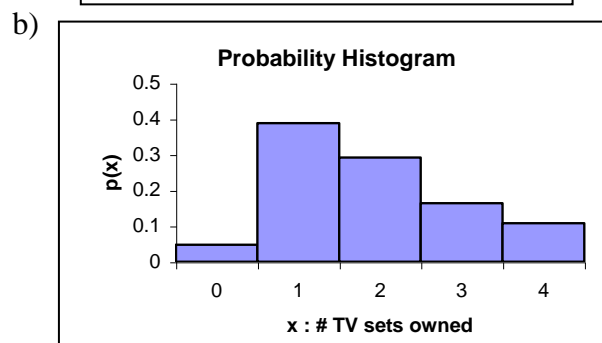
Probability Distribution	
$x$	$p_x$
0	0.193
1	0.463
2	0.295
3	0.049



- c) 1.2  
 d) 0.803

5. a)

Probability Distribution	
$x$	$p_x$
0	0.048
1	0.388
2	0.292
3	0.164
4	0.108



- c) 0.272  
 d) 0.436  
 e) 0.680  
 f) 1.896  
 g) 1.079

6. -\$0.28

7. -\$0.20

8. a) 0.0000000477

b) 0.1699 or 1 in 5.9

c) 52.6%

Category	Prize	Probability
7/7	\$7,022,522*	0.0000000477
6/7+ bonus	\$68,713*	0.000000334
6/7	\$1,762*	0.0000130
5/7	\$100*	0.000781
4/7	\$10	0.0165
3/7+ bonus	\$10	0.0153
3/7	Free Ticket	0.1373