

Date: 06.03.2013

Teacher: Ceren Özbay

Number of Students: 16

Grade Level: 11I / IB SL

Time Frame: 40 minutes

Binomial Distribution

1. Goal(s)

- To develop an understanding of binomial distribution

2A. Specific Objectives (measurable)

- Students will be able to define the binomial distribution function.
- Students will be able to apply the binomial distribution to a variety of problems.
- Students will be understand how to find mean and variance of the distribution.

2B. Ministry of National Education (MoNE) Objectives

- The topic is not covered in MoNE curriculum.

2C. NCTM-CCSS-IB or IGCSE Standards:

- The aims of this topic are to allow students the opportunity to approach statistics in practical way; to demonstrate a good level of statistical understanding; and to understand which situations apply and to interpret the given results. (IB)

3. Rationale

- Basically, anything students can think of that can only be a success or a failure can be represented by a binomial distribution. For instance if a new drug is introduced to cure a disease, it either cures the disease (it's successful) or it doesn't cure the disease (it's a failure) which is directly related to the real life.

4. Materials

- Board.
- At least two different colored board markers.
- One worksheet to each student.
- Projector
- TI calculator
- Computer

5. Resources

- Haese & Harris Publications. Mathematics for the international student Mathematics SL book. The authors are Paul Urban, John Owen, David Martin, Robert Haese, Sandra Haese, and Mark Bruce.
- IB sample exam papers related to the topic.

6. Getting Ready for the Lesson (Preparation Information)

- Teacher should make sure that she gets the worksheets.
- Teacher will check the computer.
- Teacher will be sure that board markers are working.
- Teacher will remind students they are supposed the do the rest of questions on the worksheet as homework.

7. Prior Background Knowledge (Prerequisite Skills)

- Students should know about the topic combination.

- Students should know about probability.
- Students should know the meaning of the mean and variance.

Lesson Procedures

Transition: Good morning class! Today, we are going to learn binomial distribution.

8A. Engage (5 minutes)

- Ask to students “Do you know the mean binomial?” and wait for a second.
- Tell the students “bi” refers to the number two and binomial is a mathematical expression with two terms.
- Then write on the board yes/no, success/ failure. And say: binomial distribution includes two different classifications.
- Give the example : if a new drug is introduced to cure a disease, it either cures the disease (it’s successful) or it doesn’t cure the disease (it’s a failure).

Transition: Let’s have a look at the question.

B. Explore (10 min.)

- Project the question:
Jack and Theo will each visit the local leisure center to swim on one evening next week but have no made arrangement between themselves to meet or go on any particular day. The random variable X is “the number of the two who go to the leisure center on Wednesday”. Find the probability distribution.
- Let students write on their notebooks.
- Students will try to solve the question.
- Walk around and ask “how did you get this answers?” and help students.
- Check the students whether they solve the problems or not.
- If somebody solves the question, let her /his solve it on the board.
- Students can use TI-84 just for calculating.

Transition: have you realized any formula?

C. Explain (10 min.)

- Let students help the teacher when writing the formula on the board.
- Then write the formula as follows:

Consider a binomial experiment for which p is the probability of a *success* and $1 - p$ is the probability of a *failure*.

If there are n independent trials then the probability that there are r *successes* and $n - r$ *failures* is $P(X = r) = \binom{n}{r} p^r (1 - p)^{n-r}$ where $r = 0, 1, 2, 3, 4, \dots, n$.

$P(X = r)$ is the **binomial probability distribution function**.

The **expected or mean outcome** of the experiment is $\mu = E(X) = np$.

If X is the random variable of a binomial experiment with parameters n and p , then we write $X \sim B(n, p)$ where \sim reads “*is distributed as*”.

- Asks for justification and clarification from students.
- Then ask to the students: how about mean and variance? Also ask the meaning of the mean and variance.
- The write on the board:

Suppose X is a binomial random variable with parameters n and p , so $X \sim B(n, p)$.

- The mean of X is $\mu = np$.
- The standard deviation of X is $\sigma = \sqrt{np(1-p)}$.
- The variance of X is $\sigma^2 = np(1-p)$.
- Ask to students whether they have problems or not.
- Then solve the question of the following on the board:

Example 8

72% of union members are in favour of a certain change to their conditions of employment. A random sample of five members is taken. Find the probability that:

- three members are in favour of the change in conditions
- at least three members are in favour of the changed conditions.

Let X denote the number of members in favour of the changes, then as $n = 5$,
 $r = 0, 1, 2, 3, 4$ or 5 and $p = 72\% = 0.72$
 r is distributed as $\text{Bin}(5, 0.72)$.

$$\text{a } P(x = 3) = \text{binompdf}(5, 0.72, 3) \\ \doteq 0.2926$$

$$\text{b } P(x \geq 3) = 1 - P(x \leq 2) \\ = 1 - \text{binomcdf}(5, 0.72, 2) \\ \doteq 0.8623$$



Transition: If you have no questions, let's solve more problems.

D. Extend (15 min.)

- Distribute the worksheet.
- Students will try to solve questions about binomial distributions on the worksheet.
- Walk around and ask "how did you get this answers?"
- Check the students whether they solve the problems or not.
- answers will be checked on the board by writing the questions on the board

Transition: good job! Thank you, class. Have a nice day!

E. Evaluate (During the whole lesson):

- Assesses students' knowledge and skills through oral questions.
- Observe the students during the lesson.
- Take notes students' name if they have a problem when they solve questions.

9. Closure & Relevance for Future Learning

- Ask students to explain what they learn today.
- Then, Want students to write 3 key words that they have learned this lesson on their notebooks.
- Assign students to do the rest of the questions on the worksheet.

11. Modifications

- If students cannot remember previous lesson, give them some clues.

- If students do not give answer to your questions, wait 20 seconds more.
- Choose simple questions firstly to solve on the board.



T.C.
MİLLÎ EĞİTİM BAKANLIĞI

TED ANKARA COLLEGE FOUNDATION HIGH SCHOOL
WORKSHEET

1.

Assuming that the births of boys and girls are equally likely, calculate the probability that in a family of six children:

- a all the children are boys b there are exactly 2 boys
c there are more than 4 girls d there are more boys than girls.

2.

A coin is tossed 10 times and X is the number of heads which occur. Find the mean and standard deviation of the X -distribution.

3.

Suppose X is $\text{Bin}(3, p)$.

- a Find $P(0)$, $P(1)$, $P(2)$ and $P(3)$ using

$$P(x) = C_x^3 p^x q^{3-x}$$

and display your results in a table:

x_i	0	1	2	3
p_i				

4.

Bolts produced by a machine vary in quality. The probability that a given bolt is defective is 0.04. A random sample of 30 bolts is taken from the week's production. If X denotes the number of defectives in the sample, find the mean and standard deviation of the X -distribution.

5.

From data over the last twenty years it is known that when a car collides with a large animal such as a cow or horse or deer, the chance of death of people in the car is approximately 0.037. There have been 243 such collisions. Find the mean and standard deviation of the number of fatalities.

- Jack and Theo will each visit the local leisure center to swim on one evening next week but have no made arrangement between themselves to meet or go on any particular day. The random variable X is “the number of the two who go to the leisure center on Wednesday”. Find the probability distribution.

72% of union members are in favour of a certain change to their conditions of employment. A random sample of five members is taken. Find the probability that:

- a** three members are in favour of the change in conditions
- b** at least three members are in favour of the changed conditions.