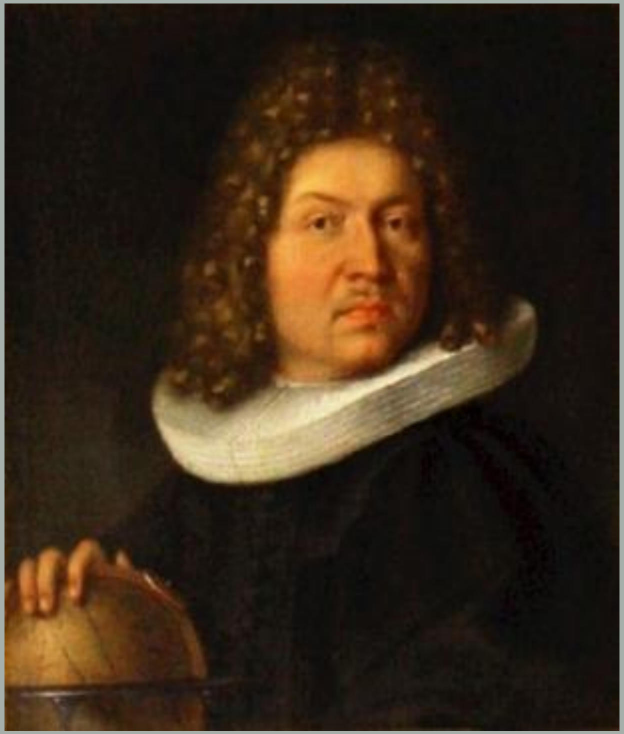
ICCPP-STATISTICS
- Binomial test

Vishal Lohchab

Scientific Assistant of
Prof. Dr. Hans-Werner Gessmann
Director ICCPP International



Jakob Bernoulli (1655-1705)

Binomial test

Definition

- The binomial test of significance is a kind of probability test that is based on various rules of probability.
- It involves the testing of the difference between a sample proportion and a given proportion.

Formula

$$P(X) = \frac{n!}{(n - X)!\,X!} \cdot (p)^X \cdot (q)^{n - X}$$

- x = total number of "successes" (pass or fail, heads or tails etc.)
- P = probability of a success on an individual trial
- n = number of trials
- q = The probability of failure (subtract your probability of success from 1)

Use

- The binomial test is used when an experiment has two possible outcomes (i.e. success/failure) and you have an idea about what the probability of success is.
- A binomial test is run to see if observed test results differ from what was expected.
- It is used to examine the distribution of a single dichotomous variable in the case of small samples.

Assumptions

Several assumptions are made for the test. Your population must be approximately normally distributed (i.e. fit the shape of a bell curve) in order to use the test.

Plus, the samples must be independent events. In addition, you'll want to bear in mind a few important points:

Assumptions

- The larger variance should always go in the numerator (the top number) to force the test into a right-tailed test.
- Right-tailed tests are easier to calculate.

Assumptions

- For two-tailed tests, divide alpha by 2 before finding the right critical value.
- If you are given standard deviations, they must be squared to get the variances.

Assumptions

- If your degrees of freedom aren't listed in the F Table, use the larger critical value.
- This helps to avoid the possibility of Type I errors.

Example

- 80% of people who purchase pet insurance are women. If 9 pet insurance owners are randomly selected, find the probability that exactly 6 are women.

Solution Steps wise

Step 1

Identify ‘n’ from the problem.

Using our example question, n (the number of randomly selected items) is 9.

Solution Steps wise

Step 2

Identify 'X' from the problem.

X (the number you are asked to find the probability for) is 6.

+ Solution Steps wise

Step 3

Work the first part of the formula. The first part of the formula is

$$n! / (n - X)!\ \ X!$$

Substitute your variables:

$$9! / ((9 - 6)! \times 6!)$$

Which equals 84. Set this number aside for a moment.

Solution Steps wise

Step 4

Find p and q.

p is the probability of success and

q is the probability of failure.

We are given $p = 80\%$, or .8.

So the probability of failure is $1 - .8 = .2$ (20%).

Solution Steps wise

Step 5

Work the second part of the formula.

$pX = .86$

$= .262144$

Set this number aside for a moment.

Solution Steps wise

Step 6

Work the third part of the formula.

$q(n - X)$

$= .2(9-6)$

$= .23$

$= .008$

Solution Steps wise

Step 7

Multiply your answer from step 3, 5, and 6 together.

$84 \times .262144 \times .008 = 0.176.$

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References

http://www.graphpad.com/guides/prism/6/statistics/index.htm?stat_binomial.html

Howell, David C. (2007). Statistical methods for psychology (6. ed.). Belmont, Calif.: Thomson. ISBN 978-0495012870.

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