

INKMATHS FLASHCARDS

Further Statistics 1 distributions and tests

14 cards · fronts and backs

Print double-sided, flipping on the long edge, and each answer lands behind its question. Cut along the card borders.

Definitions in precise wording, the standard results the formulae booklet does not print, a check-yourself question per topic, and the slips that lose marks. The same cards run on the website with spaced-repetition scheduling, at inkphysics.co.uk/maths/flashcards.

STANDARD RESULT

Discrete variance:

$$\text{Var}(X) = ?$$

FURTHER STATISTICS 1: DISTRIBUTIONS AND TESTS

STANDARD RESULT

Linear transformation:

$$\text{Var}(aX + b) = ?$$

FURTHER STATISTICS 1: DISTRIBUTIONS AND TESTS

STANDARD RESULT

Poisson:

$$X \text{ is Po}(\lambda): P(X = x) = ?$$

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STANDARD RESULT

Geometric:

$$X \text{ is Geo}(p), x = 1, 2, 3, \dots: P(X = x) = ?, \mu = ?, \sigma^2 = ?$$

FURTHER STATISTICS 1: DISTRIBUTIONS AND TESTS

STANDARD RESULT

Negative binomial:

$$\text{rth success on trial } x: P = ?$$

FURTHER STATISTICS 1: DISTRIBUTIONS AND TESTS

RECALL

State what the Central Limit Theorem buys you.

FURTHER STATISTICS 1: DISTRIBUTIONS AND TESTS

RECALL

State how a Poisson hypothesis test differs from a binomial one.

FURTHER STATISTICS 1: DISTRIBUTIONS AND TESTS

STANDARD RESULT

Goodness of fit:

$$\chi^2 = ?$$

FURTHER STATISTICS 1: DISTRIBUTIONS AND TESTS

STANDARD RESULT **$\sigma^2 \text{Var}(X)$. The shift b contributes nothing**

FURTHER STATISTICS 1: DISTRIBUTIONS AND TESTS

STANDARD RESULT **$\sum x^2 P(X = x) - \mu^2$**

FURTHER STATISTICS 1: DISTRIBUTIONS AND TESTS

STANDARD RESULT **$p(1-p)^{x-1}, (1)/(p), (1-p)/(p^2)$**

FURTHER STATISTICS 1: DISTRIBUTIONS AND TESTS

STANDARD RESULT **$e^{-\lambda}(\lambda^x)/(x!), \text{ with } E(X) = \text{Var}(X) = \lambda$**

FURTHER STATISTICS 1: DISTRIBUTIONS AND TESTS

RECALL

For a large enough sample of independent observations from one distribution of finite variance, the mean is approximately normal whatever that population looks like, with mean μ and variance σ^2/n . The mean and variance hold for any n . Normal is the theorem's whole contribution, so quote the sample size when you lean on it.

FURTHER STATISTICS 1: DISTRIBUTIONS AND TESTS

STANDARD RESULT **$x^{-1}C_{r-1} p^r(1-p)^{x-r}, \mu = (r)/(p)$**

FURTHER STATISTICS 1: DISTRIBUTIONS AND TESTS

STANDARD RESULT **$\sum ((O_i - E_i)^2)/(E_i)$**

FURTHER STATISTICS 1: DISTRIBUTIONS AND TESTS

RECALL

The machinery is identical, only the distribution under the null changes. Test λ rather than p , and scale λ to the interval the question actually observes before you touch the tables. For a geometric model the tail is easy, since $P(X \geq x)$ is just $(1-p)$ to the power $x-1$.

FURTHER STATISTICS 1: DISTRIBUTIONS AND TESTS

STANDARD RESULT

Contingency table:

$E_{ij} = ?$, degrees of freedom?

FURTHER STATISTICS 1: DISTRIBUTIONS AND TESTS

STANDARD RESULT

Generating function:

$G(t) = ?$, mean = ?

FURTHER STATISTICS 1: DISTRIBUTIONS AND TESTS

STANDARD RESULT

Variance from a PGF:

$\text{Var}(X) = ?$

FURTHER STATISTICS 1: DISTRIBUTIONS AND TESTS

DEFINITION

Define: Power of a test.

FURTHER STATISTICS 1: DISTRIBUTIONS AND TESTS

SPOT THE ERROR

Say what is wrong with this claim:

A test at the 5% level is wrong 5% of the time.

FURTHER STATISTICS 1: DISTRIBUTIONS AND TESTS

CHECK YOURSELF

A goodness-of-fit test has 6 classes after pooling, with one parameter estimated from the data. State the degrees of freedom.

FURTHER STATISTICS 1: DISTRIBUTIONS AND TESTS

STANDARD RESULT

$$E(t^x), \text{ mean} = G'(1)$$

FURTHER STATISTICS 1: DISTRIBUTIONS AND TESTS

STANDARD RESULT

$$(\text{row} \times \text{column}) / (\text{total}), (r-1)(c-1)$$

FURTHER STATISTICS 1: DISTRIBUTIONS AND TESTS

DEFINITION

The probability of correctly rejecting the null hypothesis at a stated alternative, equal to one minus the probability of a Type II error there.

FURTHER STATISTICS 1: DISTRIBUTIONS AND TESTS

STANDARD RESULT

$$G''(1) + G'(1) - [G'(1)]^2$$

FURTHER STATISTICS 1: DISTRIBUTIONS AND TESTS

CHECK YOURSELF

$6 - 1 - 1 = 4$. One degree of freedom goes to the fixed total and one to the estimated parameter.

FURTHER STATISTICS 1: DISTRIBUTIONS AND TESTS

SPOT THE ERROR

The 5% is the level the test is set to. The chance of rejecting a true null is the test's size, the probability of the critical region given H_0 , and a discrete test lands at or below the nominal 5%. It says nothing about Type II errors, which are often far more likely, and it is a conditional probability rather than an overall error rate.

FURTHER STATISTICS 1: DISTRIBUTIONS AND TESTS