# Further Mathematics: FS1 Topic Questions

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taught by Zameer ul-Hassan, David Game College

**Yunkai Zhang**

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# 1. Discrete Probability Distributions

**Examinable Contents**

- Calculation of the mean and variance of discrete probability distributions.
- Extension of expected value function to include E(g(X))

# 2. Poisson & Binomial Distributions

**Examinable Contents**

- The Poisson distribution and its additive properties
- The mean and variance of the Binomial Distribution and the Poisson distribution
- The use of the Poisson distribution as an approximation to the binomial distribution.

# 3. Geometric and Negative Binomial Distributions

**Examinable Contents** *All topics A2 only.*

- Geometric and negative binomial distributions.
- Mean and variance of a geometric distribution with parameter $p$
- Mean and variance of negative binomial distribution with $P(X=x)=\binom{x-1}{r-1}p^r(1-p)^{x-r}$

# 4. Hypothesis Testing

**Examinable Contents**

- Extend ideas of hypothesis tests to test for the mean of a Poisson distribution
- (A2 only) Extend hypothesis testing to test for the parameter p of a geometric distribution.

# 5. Central Limit Theorem

**Examinable Contents**

- (A2 only) Applications of the central Limit Theorem to other distributions.

# 6. Chi-Squared Tests

**Examinable Contents**

- Goodness of fit tests and Contingency Tables
- The null and alternative hypotheses.
- The use $\sum_{i=1}^{n}\frac{(O_i-E_i)^2}{E_i}$ as an approximate $\chi^2$ statistic.
- Degrees of freedom

## 6.1. WJEC

Bags of £1 coins are paid into a bank. Each bag contains 20 coins.

The bank manager believes that 5% of the £1 coins paid into the bank are fakes. He decides to use the distribution $X\sim B(20, 0.05)$ to model the random variable X, the number of fake £1 coins in each bag.

The bank manager checks a random sample of 150 bags of £1 coins and records the number of fake coins found in each bag. His results are summarised in Table 1. He then calculates some of the expected frequencies, correct to 1 decimal place.

## 7. Probability Generating Functions

**Examinable Contents** *All topics A2 only.*

- Definitions, derivations and applications.
- Use of the probability generating function for the negative binomial, geometric, binomial and Poisson distributions.
- Use to find the mean and variance.
- Probability generating function of the sum of independent random variables.

## 8. Quality of Tests

**Examinable Contents** *All topics A2 only.*

- Type I and Type II errors.
- Size and Power of Test.
- The power function.