

Continuous Distribution - Normal- Exam Questions

1 Approximations

1.1 Poisson

1.1.1 Cases where normal can be used to approximate poisson

- $\lambda > 10$

1.1.2 Conversion

$$X \sim P_o(\lambda)$$

$$X \sim N(\lambda, \lambda)$$

1.1.3 Continuity correction

As the poisson distribution is discrete and the normal distribution is continuous continuity correction must be used.

Probability	Corrected Probability
$P(X = n)$	$P(n - 0.5 < X < n + 0.5)$
$P(X > n)$	$P(X > n + 0.5)$
$P(X \leq n)$	$P(X < n + 0.5)$
$P(X < n)$	$P(X < n - 0.5)$
$P(X \geq n)$	$P(X > n - 0.5)$

1.1.4 Example question

During the summer the mean number of yachts hired per week is 25.

The company has only 30 yachts for hire.

Using a suitable approximation find the probability that the demand for yachts cannot be met on a particular Saturday in the summer.

Let X Represent the number of yachts hired

$$X \sim P_o(25)$$

$$X \sim N(25, 25)$$

Write inequality

$$P(X > 30)$$

Apply continuity correction

$$P(X > 30.5)$$

Do Z transformation

$$Z = \frac{30.5 - 25}{5} = 1.1$$

Lookup value in tables

$$0.8643$$

Subtract from one as probability is greater than

$$1 - 0.8643 = 0.1357$$

1.2 Binomial

1.2.1 Conditions for normal to approximate binomial

- $n > 10$
- $p < 0.5$

1.2.2 Conversion

$$X \sim B(n, p)$$

$$X \sim N(np, np(1 - p))$$

1.2.3 Continuity correction

Binomial will also require continuity correction when approximated to normal as it is discrete and normal is continuous.

Probability	Corrected Probability
$P(X = n)$	$P(n - 0.5 < X < n + 0.5)$
$P(X > n)$	$P(X > n + 0.5)$
$P(X \leq n)$	$P(X < n + 0.5)$
$P(X < n)$	$P(X < n - 0.5)$
$P(X \geq n)$	$P(X > n - 0.5)$

1.2.4 Example Question

In a large college 58% of students are female and 42% are male.

A random sample of 100 students is chosen from the college.

Using a suitable approximation find the probability that more than half the sample are female. Write the question in the binomial for females

$$X \sim B(100, 0.58)$$

Use the conversion formula to convert to normal

$$X \sim N(58, 24.36)$$

Write the inequality then apply continuity correction

$$P(X > 50) \rightarrow P(X > 50.5)$$

Find the Z value

$$Z = \frac{50.5 - 58}{\sqrt{24.36}} \approx -1.52$$

Convert the Z value to a probability using the tables

$$p = 0.9357$$