

## **4B Finding Critical Regions for a Poisson Distribution**

Critical region:

Critical value:

One-tailed test ( $H_1: \lambda < m$  or  $H_1: \lambda > m$ ):

Two-tailed test ( $H_1: \lambda \neq m$ ):

Actual significance level:

1. An estate agent has been selling houses at a rate of 9 per month. He believes that the rate of sales will decrease in the next month.
  - a) Using a 5% level of significance, find the critical region for a one-tailed test of the hypothesis that the rate of sales will decrease from 9 per month.

| <b>x</b>        | <b>2</b> | <b>3</b> | <b>4</b> | <b>5</b> |
|-----------------|----------|----------|----------|----------|
| <b>P(X ≤ x)</b> | 0.0062   |          |          |          |

- b) Write down the actual significance level of the test in part a.

2. Leonora Metti is regarded as a super striker who plays for Statistics All Stars. The mean number of goals she has scored over the several years she has been with the club is 0.7 goals per game. She has now been transferred to Mechanics Ladies. The management at Mechanics Ladies wish to see if the rate at which she scores goals has now increased. They monitor the number of goals that she scores in her first 10 games.

Assuming a Poisson distribution,

- a) use a 5% level of significance to find the critical region for a one-tailed test of the hypothesis that Leonora has increased her rate of scoring from 0.7 goals per game

| <b>x</b>            | <b>10</b> | <b>11</b> | <b>12</b> | <b>13</b> |
|---------------------|-----------|-----------|-----------|-----------|
| <b>P(X ≤ x)</b>     | 0.9015    |           |           |           |
| <b>P(X ≥ x + 1)</b> | 0.0985    |           |           |           |

b) write down the actual significance level of the test in part a.

Leonora scores 11 goals in her first 10 games for Mechanics Ladies.

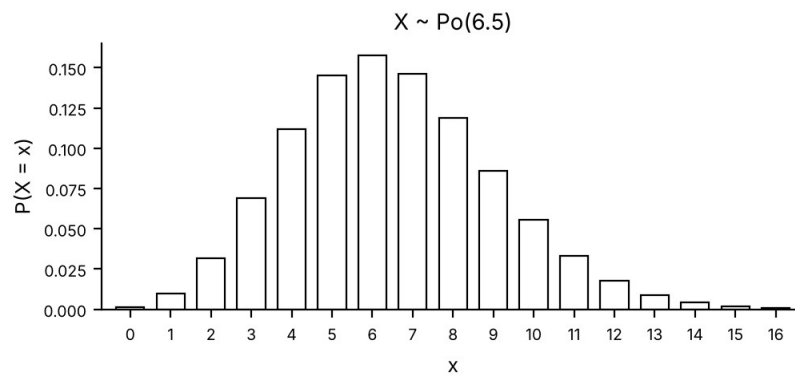
c) Comment on this observation in light of your critical region.

3. An office finds that, over a long period of time, incoming calls from customers occur at a rate of 0.325 per minute. They believe that the rate of calls has changed recently. To test this, the number of incoming calls during a random 20-minute interval is recorded.

a) Find the critical region for a two-tailed test of this hypothesis. The probability in each tail should be as close to 2.5% as possible.

| <b>x</b>        | <b>0</b> | <b>1</b> | <b>2</b> | <b>3</b> | <b>10</b> | <b>11</b> | <b>12</b> | <b>13</b> |
|-----------------|----------|----------|----------|----------|-----------|-----------|-----------|-----------|
| <b>P(X ≤ x)</b> | 0.0015   |          |          |          | 0.9332    |           |           |           |

Shade the critical region on the diagram:



b) Write down the actual significance level of the test.

The actual number of calls recorded in the 20-minute period was 13.

c) Comment on this observation in light of your critical region.