 NESA exemplar question solutions

S5 The normal distribution

Solutions for questions from the NESA topic guidance related to the normal distribution.

1. Packets of rice are each labelled as having a mass of kg. The mass of these packets is normally distributed with a mean of kg and a standard deviation of kg. Complete the following table:

| Mass in kg | 1.00 | 1.01 | 1.02 | 1.03 | 1.04 |
| --- | --- | --- | --- | --- | --- |
| -score | -2 | -1 | 0 | 1 | 2 |

1. What percentage of packets will have a mass less than kg?

Solution*:*

1. What percentage of packets will have a mass between and kg?

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*:*

1. What percentage of packets will have a mass less than the labelled mass?
2. A machine is set for the production of cylinders of a mean diameter cm, with standard deviation cm. Assuming a normal distribution, between which values will of the diameters lie? If a cylinder, randomly selected from this production, has a diameter of cm, what conclusions could be drawn?

Solution*:* When , SD

| Diameter in cm | 4.96 | 4.98 | 5.00 | 5.02 | 5.04 |
| --- | --- | --- | --- | --- | --- |
| -score | -2 | -1 | 0 | 1 | 2 |

of the cylinders have a diameter of between and cm

When , SD

As cm has a -score of it is highly unlikely that it would be selected at random as only of values lie outside of standard deviations above the mean. It may also indicate a possible error in the measurement or analysis.

1. Find the probability that a person selected at random from a pool of people that took a test on which the mean was and the standard deviation was will have a score of:

Note: [Normal distribution tables](http://www.ztable.net) would be used to answer this question.

1. between and

Solution*:* When , SD

Using the z-score table on page , a -score of indicates that the area to the left is and the area to the left of the mean is

The probability that the score is between 100 and 120 is:

1. of at least

Solution: From part a above. A score of results in a -score of . Using the -table below it indicates that the probability to the left of is .

The probability that the score is at least is .

1. of greater than

Solution:

Probability of the score being greater than

Probability of the score being greater than

1. The lifetime of a particular lightbulb is normally distributed with mean of hours and standard deviation hours. Find the probability that a lightbulb of the same make chosen at random has a lifetime between and hours.

Normal distribution tables would be used to answer this question.

Solution*:* When , SD

When , SD

Using the -Table on page , the area to the left of a -score of is and the area to the left of a -score of is .

The probability that the lifetime of the lightbulb is between and

The probability that the lifetime of the lightbulb is between and