# M1.9 – Select and use a statistical test

## Teacher answers

### Quiz

1. We measured the mass of nine sample adult males in each of two separate populations of elephants (**A** and **B**), and want to know if the means of the two populations are different.

| Sample number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Population **A** mass of adult male (kg) | 6000 | 5590 | 6124 | 5800 | 5987 | 6020 | 5900 | 6143 | 5699 |
| Population **B** mass of adult male (kg) | 4100 | 5900 | 4867 | 5010 | 5534 | 5321 | 5987 | 5350 | 5478 |

1. Calculate the means and standard deviations for the two populations

Popn **A** Mean = 5918, S.D. = 188.6

Popn **B** Mean = 5283, S.D. = 573.4

1. Which statistical test is appropriate for testing the hypothesis that there is a difference in the mean mass of adult male elephants between these two populations?

Student’s *t*-test

1. Calculate whether there is a significant difference between these means

*t* = $\frac{(5918-5283)}{\sqrt{\frac{(188.6)^{2}}{9} }+ \frac{(573.4)^{2}}{9}}$

*t* = 3.156

At 16 d.f., p=0.05 this is > critical value of 2.12, therefore there is a significant difference

1. For which one or more of the following is a Spearman’s rank correlation coefficient the appropriate statistical test to use?

**A** Comparing the relationship between grey seal pup size and fat reserves

**B** Comparing the frequency of different species of bluebell in a woodland

**C** Describing the relationship between the numbers of ladybirds and the numbers of aphids in 10 different meadows

**D** Comparing the average growth of bacteria on two types of agar plate, where one has been treated with penicillin

**A** Comparing the relationship between grey seal pup size and fat reserves

**C** Describing the relationship between the numbers of ladybirds and the numbers of aphids in 10 different meadows

1. Equal amounts of two types of the bacteria *E.coli* are mixed together in a volumetric flask, one of these populations of *E.coli* is carrying an antibiotic resistance gene. The mixture is then poured out onto agar plates that have been inoculated with penicillin and incubated for 24 hours. Based on previous experiments, when we count the bacteria, we expect there to be twice as many colonies on the plate with the resistance gene as without. If we found 846 colonies on our plates the next day, and 432 of them carried the resistance marker, does this differ significantly from our expected frequency?

|  |  |  |
| --- | --- | --- |
|  | Expected | Observed |
| Resistant | 564 | 432 |
| Wild type | 282 | 414 |

*χ2* = $\frac{(432-564)^{2}}{564}+ \frac{(414-282)^{2}}{282}=84.83$

d.f. = 1

The critical value for df = 1 at p= 0.05 is 3.84

84.83 > 3.84

There **is** a significant difference from the expected frequency.

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