Two-Sample t-Test: exam practice

10 questions · 34 marks · worked solutions and markschemes

Name _____ Date _____ Score / 34

- Answer every question before you look at the solutions. They start after the last question, with the marks for each line: M for method, A for accuracy, R for reasoning.
- Online, with more practice: ibmathrevision.com/hlai/two-sample-t-test-exam-practice

1. **2 marks · Paper 1 style · calculator allowed**

State two assumptions for a pooled two-sample t-test.

State them. **[2]**

2. **2 marks · Paper 2 style · calculator allowed**

A two-sample t-test gives $p = 0.072$.

State the conclusion at the 5% level and at the 10% level. **[2]**

3. **2 marks · Paper 1 style · calculator allowed**

Write the null and alternative hypotheses for testing whether a new teaching method raises the mean score above the old method.

Write H_0 and H_1. **[2]**

4. **2 marks · Paper 1 style · calculator allowed**

Explain the difference between a one-tailed and a two-tailed test.

Explain. **[2]**

5. **2 marks · Paper 2 style · calculator allowed**

A two-sample t-test is done at the 5% level and H_0 is rejected.

State the probability of a type I error and describe it in context of comparing two means. **[2]**

6. **4 marks · Paper 2 style · calculator allowed**

Two samples have $n_1 = 10$, $\bar{x}_1 = 24.3$, $s_1 = 2.1$ and $n_2 = 12$, $\bar{x}_2 = 22.1$, $s_2 = 2.5$ (unbiased estimates). Test at the 5% level whether the means differ.

Carry out a pooled two-sample t-test. **[4]**

7. **5 marks · Paper 2 style · calculator allowed**

Test scores for two classes are: class A $72,\ 68,\ 75,\ 80,\ 66,\ 71,\ 77$; class B $65,\ 70,\ 62,\ 68,\ 64,\ 66$. Test at the 5% level whether class A has a higher mean (pooled variance).

Carry out the test. **[5]**

8. **5 marks · Paper 2 style · calculator allowed**

Two fertilisers are compared. Plant heights (cm): fertiliser C $12.4,\ 13.1,\ 11.8,\ 12.9,\ 13.5,\ 12.2$; fertiliser D $13.0,\ 13.8,\ 12.9,\ 14.1,\ 13.6,\ 13.3$. Test at the 5% level whether the means differ.

Carry out the test. **[5]**

9. **5 marks · Paper 2 style · calculator allowed**

Reaction times (tenths of a second) for two groups: group E $5.2,\ 4.8,\ 5.5,\ 5.0,\ 4.9,\ 5.3,\ 5.1,\ 4.7$; group F $4.6,\ 4.9,\ 4.4,\ 4.8,\ 4.5,\ 4.7,\ 4.3,\ 4.6$. Test at the 1% level whether group E is slower.

Carry out the test. **[5]**

10. **5 marks · Paper 2 style · calculator allowed**

The number of sit-ups in a minute for two teams: team G $31,\ 28,\ 35,\ 30,\ 33,\ 29,\ 34$; team H $27,\ 30,\ 26,\ 29,\ 25,\ 28,\ 27$. Test at the 5% level whether team G does more.

Carry out the test. **[5]**

Answers and worked solutions

Question 1 — 2 marks

Answer: a proof: the worked solution above is the full answer

both populations are normally distributed **A1**

the two populations have equal variances (and the samples are independent) **A1**

Question 2 — 2 marks

Answer: do not reject at 5%; reject at 10%

5%: do not reject H_0 **A1**

10%: reject H_0 **A1**

Question 3 — 2 marks

Answer: a proof: the worked solution above is the full answer

$H_0 : \mu_{\text{new}} = \mu_{\text{old}}$ **A1**

$H_1 : \mu_{\text{new}} > \mu_{\text{old}}$ **A1**

Question 4 — 2 marks

Answer: a proof: the worked solution above is the full answer

one-tailed: H_1 states a direction ($>$ or $<$) **A1**

two-tailed: H_1 is $\neq$ **A1**

Question 5 — 2 marks

Answer: 0.05

0.05 **A1**

concluding the means differ when they are equal **A1**

Question 6 — 4 marks

Answer: $t = 2.21$, $p = 0.0392$; reject H_0

$t = 2.21$ **A1**

$\text{df} = 20$ **A1**

$p = 0.0392$ **A1**

reject H_0 **R1**

Question 7 — 5 marks

Answer: $t = 2.99$, $p = 0.00615$; reject H_0

$H_0 : \mu_A = \mu_B$, $H_1 : \mu_A > \mu_B$ **A1**

pooled two-sample t–test **M1**

$t = 2.99$ **A1**

$p = 0.00615$ **A1**

$p < 0.05$: reject H_0 **R1**

Question 8 — 5 marks

Answer: $t = -2.50$, $p = 0.0314$; reject H_0

$H_0 : \mu_C = \mu_D$, $H_1 : \mu_C \neq \mu_D$ **A1**

pooled t–test **M1**

$t = -2.50$ **A1**

$p = 0.0314$ **A1**

reject H_0 **R1**

Question 9 — 5 marks

Answer: $t = 3.92$, $p = 0.000767$; reject H_0

$H_1 : \mu_E > \mu_F$ **A1**

pooled t–test **M1**

$t = 3.92$ **A1**

$p = 0.000767$ **A1**

reject H_0 **R1**

Question 10 — 5 marks

Answer: $t = 3.36$, $p = 0.00282$; reject H_0

$H_1 : \mu_G > \mu_H$ **A1**

pooled t–test **M1**

$t = 3.36$ **A1**

$p = 0.00282$ **A1**

reject H_0 **R1**

Every solution is also on ibmathrevision.com/hlai/two-sample-t-test-exam-practice
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