Solutions

Marking: **K** knowledge, **App** use of the case or data, **An** analysis (a chain of reasons: cause, then effect), **Ev** evaluation (a judgement with a reason). In calculations, **M1** is for the method and **A1** for the answer; **B1** is an independent mark.

Each answer shows the steps, then the **result**.

2.1

H_0: $\mu = 30$; H_1: $\mu < 30$

one-sided

2.2

$t = \dfrac{28.66 - 30}{4.70/4} = \mathbf{-1.14}$

$1.14 < 2.131$: fail to reject H_0

2.3

type I: deciding the bags are light when they are not, and wrongly blaming the supplier

type II: missing bags that really are light, so Nimbus keeps paying for flour it does not get

2.4

$\alpha = 0.05$: reject H_0

$\alpha = 0.01$: fail to reject

3.1

(a) H_0: $\mu = 42$; H_1: $\mu \neq 42$

(b) $SE = \dfrac{3.5}{5} = 0.7$; $t = \dfrac{40.6 - 42}{0.7} = \mathbf{-2.0}$

(c) $|-2.0| < 2.064$: fail to reject; the claim is not disproved

(d) yes, $-2.0 < -1.711$; but choosing the side after seeing the data is not fair: it doubles the real chance of a type I error

3.2

(a) test 1 only

(b) the difference is real but tiny; at most 0.7 minutes, which customers will not notice, so it does not justify a costly change

(c) 3 minutes would matter, but 8 orders are too few to tell it from chance; run a larger test before deciding

3.3

(a) $SE = \dfrac{4.0}{4} = 1.0$; $t = \dfrac{26.9 - 28.7}{1.0} = \mathbf{-1.8}$

(b) $\alpha = 0.05$: fail to reject; $\alpha = 0.10$: reject

(c) **4**: if the 1.8 minutes is real, it is worth about £540 a month, so the course pays back in about 4 months (App); a type I error costs only £2,000, while a type II error loses £540 a month (An); so a looser α such as 0.10 is reasonable here (An); judgement, e.g. train a second group and keep timing; stop if the gain disappears (Ev). **2–3**: costs of errors discussed with little use of the numbers. **1**: one relevant point.

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