

1. For $f(x) = \frac{1}{2}x$ on $[0,2]$, $F(x) = \frac{1}{4}x^2$. The median solves $\frac{1}{4}m^2 = 0.5$. What is m ? (2 dp)

2. A sample $n = 10$ has $s = 4$. With $t = 2.262$, what is the margin $t \times s/\sqrt{n}$? (2 dp)

3. Observed counts 20, 30, 25, 25, each expected 25. What is $\chi^2 = \Sigma(O-E)^2/E$?

4. The key advantage of a non-parametric test is that it makes no assumption that the data is:

- ☐ positive
- ☐ paired
- ☐ discrete
- ☐ normally distributed

5. X has $G(t) = 0.5 + 0.3t + 0.2t^2$. Since $E(X) = G'(1)$ and $G'(t) = 0.3 + 0.4t$, what is $E(X)$?

6. What must the total area under a probability density function equal?

7. You use the t -distribution (rather than the normal) when:

- ☐ the data is categorical
- ☐ the sample is small and the population variance is unknown
- ☐ the population variance is known
- ☐ the sample is very large

8. The chi-squared test statistic is:

- ☐ $\Sigma (O - E)^2/E$
- ☐ $\Sigma O/E$
- ☐ $(O - E)^2$
- ☐ $\Sigma (O - E)$

9. Under the null hypothesis, the sign test uses which distribution for the counts above/below the median?

☐ binomial with $p = \frac{1}{2}$

☐ normal

☐ Poisson

☐ chi-squared

10. The probability generating function of X is defined as:

☐ e^x

☐ $\sum P(X=x)$

☐ $E(X)$

☐ $E(t^x) = \sum P(X=x) t^x$

A-Level Further Mathematics

1. **1.41**

$$\frac{1}{4}m^2 = 0.5 \rightarrow m^2 = 2 \rightarrow m = \sqrt{2} \approx 1.41.$$

2. **2.86**

$$2.262 \times 4/\sqrt{10} = 2.262 \times 1.265 = 2.86.$$

3. **2**

$$((-5)^2 + 5^2 + 0 + 0)/25 = 50/25 = 2.$$

4. **normally distributed**

Non-parametric tests work without assuming an underlying normal distribution.

5. **0.7**

$$G'(1) = 0.3 + 0.4(1) = 0.7.$$

6. **1**

A pdf integrates to 1 over its whole range.

7. **the sample is small and the population variance is unknown**

Small n with unknown $\sigma \rightarrow$ estimate with s and use t.

8. **$\Sigma (O - E)^2/E$**

χ^2 sums (observed – expected)² ÷ expected over all categories.

9. **binomial with $p = \frac{1}{2}$**

Each value is equally likely above or below the median, so the count is binomial with $p = \frac{1}{2}$.

10. **$E(t^x) = \Sigma P(X=x) t^x$**

$$G(t) = E(t^x) = \Sigma P(X=x) t^x.$$