4. Further Probability & Statistics

Starter Quiz · 课前小测

A-Level Further Mathematics Name: _____ Score: _____

1. For f(x) = ½x on [0,2], F(x) = ¼x^2. The median solves ¼m^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 × s/√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:

   ☐ normally distributed

   ☐ positive

   ☐ discrete

   ☐ paired

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 sample is small and the population variance is unknown

   ☐ the sample is very large

   ☐ the population variance is known

   ☐ the data is categorical

8. The chi-squared test statistic is:

   ☐ $\Sigma\ (O - E)^2/E$

   ☐ $\Sigma\ (O - E)$

   ☐ $\Sigma\ O/E$

   ☐ $(O - E)^2$

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

☐ binomial with p = ½

☐ normal

☐ Poisson

☐ chi-squared

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

☐ $E(t^x) = \Sigma\ P(X=x)\ t^x$

☐ E(X)

☐ $\Sigma\ P(X=x)$

☐ e^x

A-Level Further Mathematics

1. **1.41**

   ¼$m^2 = 0.5 \rightarrow m^2 = 2 \rightarrow m = \sqrt{2} \approx 1.41$.

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 = ½**

   Each value is equally likely above or below the median, so the count is binomial with p = ½.

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

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