Applied Statistics Assessment Solutions

# Question 1

Claim: There is no significant difference between boys and girls with respect to intelligence.  
  
Data:  
- Girls → Mean = 89, SD = 4, n = 50  
- Boys → Mean = 82, SD = 9, n = 120  
- Level of Significance (α) = 0.05  
  
Step 1: Hypotheses  
H₀: μ₁ = μ₂ (No difference in intelligence)  
H₁: μ₁ ≠ μ₂ (Significant difference exists)  
  
Step 2: Formula for independent samples t-test:  
t = (X̄1 – X̄2) / √(s1²/n1 + s2²/n2)  
  
Step 3: Substitution:  
(89 – 82) / √((16/50) + (81/120)) = 7 / √(0.32 + 0.675)  
= 7 / 0.997 ≈ 7.02  
  
Step 4: Critical value at α=0.05 (two-tailed) ≈ 1.96  
  
Conclusion: Since 7.02 > 1.96 → Reject H₀.  
There is a significant difference in intelligence between boys and girls.

# Question 2

Claim: Smoking causes cancer.  
  
Data (Contingency Table):  
 Cancer | No Cancer | Total  
Smokers 220 | 230 | 450  
Non-Smokers 350 | 640 | 990  
Total 570 | 870 | 1440  
  
Step 1: Hypotheses  
H₀: Smoking and Cancer are independent (no relation)  
H₁: Smoking and Cancer are dependent (relationship exists)  
  
Step 2: Apply Chi-Square Test of Independence:  
χ² = Σ (O – E)² / E  
  
For Smokers with Cancer: E = (450\*570)/1440 = 178.13  
For Smokers without Cancer: E = (450\*870)/1440 = 271.87  
For Non-Smokers with Cancer: E = (990\*570)/1440 = 391.87  
For Non-Smokers without Cancer: E = (990\*870)/1440 = 618.13  
  
Step 3: χ² ≈ 20.05  
Degrees of freedom = (2–1)(2–1) = 1  
Critical value at α = 0.05, df=1 = 3.84  
  
Conclusion: Since 20.05 > 3.84 → Reject H₀.  
There is a strong relationship between smoking and cancer (smoking increases risk).