**Que: -1**

**Given data:**

* **Girls: xˉ1=89, s1=4, n1=50\bar x\_1 = 89, \; s\_1 = 4, \; n\_1 = 50xˉ1​=89, s1​=4, n1​=50**
* **Boys: xˉ2=82, s2=9, n2=120\bar x\_2 = 82, \; s\_2 = 9, \; n\_2 = 120xˉ2​=82, s2​=9, n2​=120**

**Test statistic (Welch two-sample t):**

**t=xˉ1−xˉ2s12n1+s22n2.t=\frac {\bar x\_1-\bar x\_2} {\sqrt{\dfrac{s\_1^2} {n\_1} +\dfrac{s\_2^2} {n\_2}}}.t=n1​s12​​+n2​s22​​​xˉ1​−xˉ2​​.**

**Compute:**

* **Difference of means: xˉ1−xˉ2=89−82=7\bar x\_1-\bar x\_2 = 89-82=7xˉ1​−xˉ2​=89−82=7.**
* **Standard error: 4250+92120≈0.99750\sqrt {\dfrac {4^2}{50} + \dfrac{9^2}{120}} \approx. 0.997505042​+12092​​≈0.99750.**
* **Test statistic: t≈70.99750≈7.0176t \approx. \dfrac {7} {0.99750} \approx. 7.0176t≈0.997507​≈7.0176.**

**Degrees of freedom (Welch–Satterthwaite approximation):**

**ν≈167.27.\nu \ approx 167.27. ν≈167.27.**

**Step 4 — Decision (two-tailed, α=0.05\alpha=0.05α=0.05)**

**Critical t for α/2=0.025\alpha/2=0.025α/2=0.025 with ν≈167\nu\approx167ν≈167 is about t0.025≈1.974t\_ {0.025} \approx 1.974t0.025​≈1.974.**

* **Observed ∣t∣=7.0176>1.974|t|=7.0176 > 1.974∣t∣=7.0176>1.974 ⇒ reject H0H\_0H0​.**

**Compute p-value:**

**p≈5.37×10−11, p \approx 5.37\times 10^ {-11}, p≈5.37×10−11,**

**which is far smaller than 0.05.**

**At the 5% level of significance, we reject the null hypothesis. There is a statistically significant difference between girls and boys — specifically, the sample shows the girls’ mean score (89) is significantly higher than the boys’ mean score (82).**

Que: -2

| **Category** | **Cancer** | **Without Cancer** | **Total** |
| --- | --- | --- | --- |
| Smokers | 220 | 230 | 450 |
| Non-Smokers | 350 | 640 | 990 |
| **Total** | 570 | 870 | 1440 |

Expected Frequency formula: -

Eji= (Row Total) × (Column Total)

Grand Total E \_ {I j} = \frac {(Row\ Total) \times (Column\ Total)} {Grand\ Total} Ei j​=Grand Total (Row Total) × (Column Total)​

**For Smokers with Cancer:**

E11=450×5701440=178.13E\_ {11} = \frac {450 \times 570} {1440} = 178.13E11​=1440450×570​=178.13

**For Smokers without Cancer:**

E12=450×8701440=271.88E \_ {12} = \ frac {450 \times 870} {1440} = 271.88E12​=1440450×870​=271.88

**For Non-Smokers with Cancer:**

E21=990×5701440=391.88E \_ {21} = \ frac {990 \times 570} {1440} = 391.88E21​=1440990×570​=391.88

**For Non-Smokers without Cancer:**

E22=990×8701440=598.13E \_ {22} = \ frac {990 \times 870} {1440} = 598.13E22​=1440990×870​=598.13

***Calculate Chi-square (χ²): -***

χ2=∑(O−E)2Eχ² = \sum \ frac {(O - E) ^2} {E}χ2=∑E(O−E)2​

| **Cell** | **O** | **E** | **(O– E) ² / E** |
| --- | --- | --- | --- |
| Smokers–Cancer | 220 | 178.13 | (41. 87) ² / 178.13 = 9.84 |
| Smokers–No Cancer | 230 | 271.88 | (-41.88) ² / 271.88 = 6.45 |
| Non-Smokers–Cancer | 350 | 391.88 | (-41.88) ² / 391.88 = 4.48 |
| Non-Smokers–No Cancer | 640 | 598.13 | (41.87) ² / 598.13 = 2.93 |

χ2=9.84+6.45+4.48+2.93=23.7χ² = 9.84 + 6.45 + 4.48 + 2.93 = 23.7χ2=9.84+6.45+4.48+2.93=23.7

**Determine Degrees of Freedom: -**

df=(r−1) ×(c−1) = (2−1) (2−1) =1df = (r - 1) \times (c - 1) = (2 - 1) (2 - 1) = 1df=(r−1) ×(c−1) = (2−1) (2−1) + 1

At **5% level of significance** and **df = 1**,  
Critical χ² value = **3.841**

Since

χcalculated2=23.7>3.841χ²\_{calculated} = 23.7 > 3.841χcalculated2​=23.7>3.841

we **reject the null hypothesis (H₀)**.