Q Tossing a coin 10 times resulted in 8 heads and 2 tails. How would you analyze whether a coin is fair? What is p-value?

Ans

	head	tail
Observed	8	2
Expected	5	5

H_0: Observed follows the distribution of expected (coin is fair)

H_a: coin is biased

$$\chi^2 = \frac{(8-5)^2}{5} + \frac{(2-5)^2}{5}$$

$$= \frac{9}{5} + \frac{9}{15}$$

$$= \frac{18}{5}$$

$$= 3.6$$

→ p_val for $\chi^2 = 3.6$ and $df = 1$ is 0.0578
→ which is > 0.05
→ we fail to reject null hypothesis
→ coin is fair.

Twist:

	head	tail
observed	80	20
expected	50	50

$$\chi^2 = \frac{(80-50)^2}{50} + \frac{(20-50)^2}{50}$$

$$= \frac{900}{50} + \frac{900}{50}$$

$$= 36$$

→ p-val for $\chi^2 = 36$ and $df = 1$ is 0.00001
→ which is < 0.05
→ we reject null hypothesis
→ coin is biased