Question 9 **(8 marks)**

A mathematics teacher uses a coin flip activity to demonstrate confidence intervals to their class. They flip a fair coin 50 times in front of the class and observe 30 heads and 20 tails.

(a) Calculate a 90% confidence interval for the proportion of heads obtained when the coin is flipped. (2 marks)

As a homework exercise, the teacher asks all 20 students in the class to repeat the coin activity and calculate their own individual 90% confidence interval for the proportion of heads. Let X be a random variable that denotes the number of students whose confidence interval contains the true proportion of heads.

(b) State the distribution for X. (2 marks)

(c) Determine the expected value and variance of X. (2 marks)

(d) Calculate the probability that the confidence intervals of three students do not contain the true proportion. (2 marks)