Binomial and Hypothesis Testing Homework

8 Mark is playing solitaire on his computer. The probability that he wins a game is 0.2, independently of all other games that he plays.

(i)	Find	the expected number of wins in 12 games.	[2]
(ii)	Find	the probability that	
	(A)	he wins exactly 2 out of the next 12 games that he plays,	[3]
	(<i>B</i>)	he wins at least 2 out of the next 12 games that he plays.	[3]

(iii) Mark's friend Ali also plays solitaire. Ali claims that he is better at winning games than Mark. In a random sample of 20 games played by Ali, he wins 7 of them. Write down suitable hypotheses for a test at the 5% level to investigate whether Ali is correct. Give a reason for your choice of alternative hypothesis. Carry out the test. [9]

- 8 The Department of Health 'eat five a day' advice recommends that people should eat at least five portions of fruit and vegetables per day. In a particular school, 20% of pupils eat at least five a day.
 - (i) 15 children are selected at random.

(A)	Find the probability that exactly 3 of them eat at least five a day.	[3]
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(B) Find the probability that at least 3 of them eat at least five a day. [3]

[2]

(C) Find the expected number who eat at least five a day.

A programme is introduced to encourage children to eat more portions of fruit and vegetables per day. At the end of this programme, the diets of a random sample of 15 children are analysed. A hypothesis test is carried out to examine whether the proportion of children in the school who eat at least five a day has increased.

- (ii) (A) Write down suitable null and alternative hypotheses for the test.
 - (B) Give a reason for your choice of the alternative hypothesis. [4]
- (iii) Find the critical region for the test at the 10% significance level, showing all of your calculations. Hence complete the test, given that 7 of the 15 children eat at least five a day. [6]

6 A manufacturer produces tiles. On average 10% of the tiles produced are faulty. Faulty tiles occur randomly and independently.

A random sample of 18 tiles is selected.

(i) (A)	Find the probability that there are exactly 2 faulty tiles in the sample.	[3]
(B)	Find the probability that there are more than 2 faulty tiles in the sample.	[3]
(C)	Find the expected number of faulty tiles in the sample.	[2]

A cheaper way of producing the tiles is introduced. The manufacturer believes that this may increase the proportion of faulty tiles. In order to check this, a random sample of 18 tiles produced using the cheaper process is selected and a hypothesis test is carried out.

- (ii) (A) Write down suitable null and alternative hypotheses for the test.
 - (B) Explain why the alternative hypothesis has the form that it does. [4]
- (iii) Find the critical region for the test at the 5% level, showing all of your calculations. [4]
- (iv) In fact there are 4 faulty tiles in the sample. Complete the test, stating your conclusion clearly.

[2]

(iii) Mark's friend Ali also plays solitaire. Ali claims that he is better at winning games than Mark. In a random sample of 20 games played by Ali, he wins 7 of them. Write down suitable hypotheses for a test at the 5% level to investigate whether Ali is correct. Give a reason for your choice of alternative hypothesis. Carry out the test.

Ho:
$$p = 0.2$$
 p is the prob he wins
Hi: $p > 0.2$ a randomly chosen game
Hi chosen as $p > 0.2$ because AI: thinks he
has a higher probability $X \sim B(20, 0.2)$
 $P(X > 7) = 1 - P(X \le 6)$
 $1 - 0.9133$
 $= 0.0867 > 5\%$ Accept H
 $p = 0.2$

There is not sufficient evidence support the view Ali has a greater chance of winning

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 $\times \sim \mathcal{G}(15, 0.2)$ (A)11 Ho: p= on P is prob a randomly chosen Hi: p70-2 child ents 5 a day Hi chan as p 70.2 because looking for increme after encourgement.

$$P(X \leq 4) = 0.8357 \qquad P(X = 5) = 1 - P(X \leq 4) = 0.8357 \qquad = 1 - 0.8357 = 0.1643 \qquad 710\%$$
$$P(X \leq 5) = 0.9389 \qquad = 1 - P(X \leq 5)$$

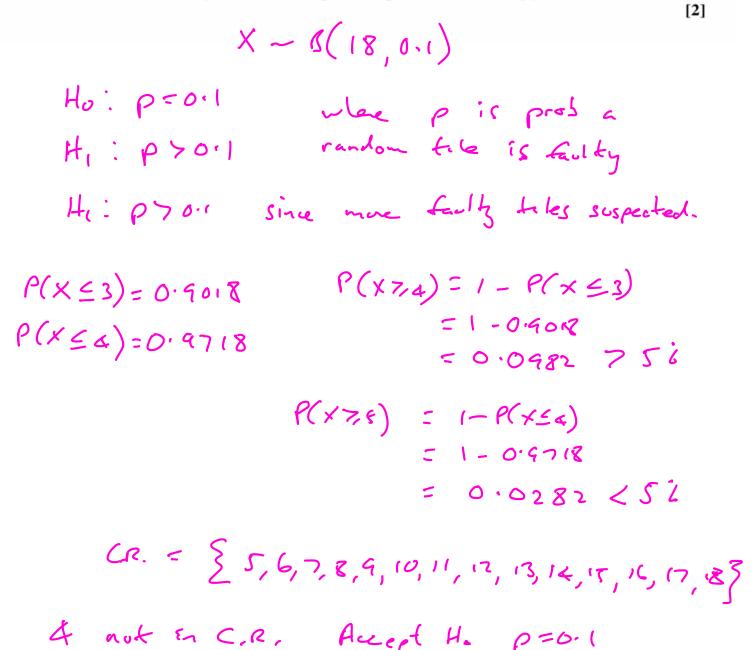
$$= 1 - 0.9389 = 0.0611 < 10\%$$

So critical regim = \$6,7,8,9,10,11,12,13,14,15} 7 is in C.R. therefore reject the and accept the prove

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