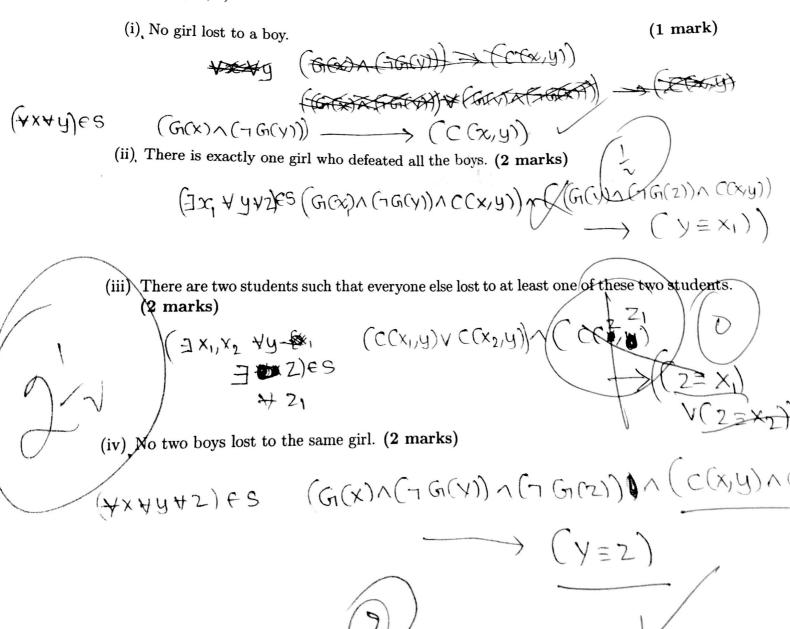


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Q1. Let S be the set of students in a class. Each pair of them play a game exactly once (assume that one of the player always wins, there is no possibility of draw in the game). Write the following logical statements using quantifiers. All quantifiers should appear at the beginning of the sentence. You can use the proposition C(x,y) which denotes x defeated y in the game, and G(x) which denotes x is a girl. You can use the usual logical operators  $(\land, \lor, =, \neq, \rightarrow, \neg)$ .



Q2/ (6 marks) You play a game where you start with the number 18. At each step, you perform one of the following perform one of the following 2 operations:

- Multiply the current number by 2.
- Multiply the current number by 3.
- Divide the current number by 2 (if it is even)
- Divide the current number by 3 (if it is divisible by 3)

For example, you can divide 18 by ain Step 1 to get 9. In Step 2, you could multiply it by 3 to get 27, and so on. Prove that you will never get the number 96 after 60 steps.

A)

$$18 = 2 \times 3^{2}$$
 $96 = 2^{5} \times 3$ 

every nhstep: (an be denoted by  $x(2.3)$ )

where  $(x_{1}, y_{1})$  (an be  $(1,0)$ )

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Q3. (6 marks) Let n be a positive integer. You are given a set of n+1 distinct positive Use mathematically distinct positive integers, each of which is less than or equal to 2n. Use mathematical induction to show that

there is at least one integer in this set that divides another integer in this set. for (n = 1)N+1= 5 rave Me the integer sets are. (with distinct humbers) possible (1,2) Cases one divides other. in each these to be true tor 1685 n assume this prove for n+1 (25P now 10 NB Mare distinct the integer each have We レキブ 2(n+1)remove e Consider two humbers (2n+1,2n+2) US maxima of the n+z distinct typ into the somether of 2n+1 or 2n+2 but not both

, we semove that number from the set we type not distinct NOW humbe maximum  $\leq 2n$  . 13% above assum WITH

we can And a at least one mumber r that divides other.

(n+2) distinct humbers contain both the IF (2n+1 and 2n+2) we remove both with. left are We h but numbers Continue reducing

maxlmum number the

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