P S G COLLEGE OF TECHNOLOGY
DEPT OF APPLIED MATHEMATICS & COMPUTATIONAL SCIENCES
18XW31 MATHEMATICAL FOUNDATIONS OF COMPUTING : ASSIGNMENT TOPICS 1
Proof Methods PS3

1. What is a conjecture ? When does it become a proof? 19PW01
2. What is Fermat's last theorem ? Relate it to proposition 19PW02
3. What is Goldbach Conjecture ? Relate it to proposition 19PW03
4. Let n be an integer. Prove that if n^2 is odd, then n is odd. 19PW04
5. If a | b and a |c then a | b+c (Direct Method) 19PW05
6. Every odd integer is a difference of 2 squares. (eg. 7=4*4 – 3*3) (direct method) 19PW06
7. Prove that $\sqrt{2}$ is irrational by contradiction. 19PW08
8. Use a proof by contradiction to prove that at least one of the numbers a1; a2; ;an is greater than or equal to the average of these numbers, (a1 +a2 +_ _ _ ; an) /n. 19PW09
9. If n ϵ Z, then 5 n^2 + 3n + 7 is odd. (Try Cases) 19PW10
10. Suppose a,bϵ Z. If both ab and a+b are even, then both a and b are even. (Contrapositive) 19PW11
11. The product of any 5 consecutive integers is divisible by 120. (3*4*5*6*7=2520=120*21) (Any Method) 19PW13
12. There exist irrational numbers x and y such that x^y is rational. (constructive proof) 19PW14
13. Prove or disprove : If A, B and C are sets, then $A-(B \cap C)=(A-B) \cap (A-C)$. (counter example) 19PW15
14. Conjecture a formula for the sum of first n +ve odd integers and prove by Mathematical Induction. 19PW16
15. Given a chocolate bar with m x n squares of chocolate, task is to divide it into mn individual squares. Only allowed to split one piece of chocolate at a time using a vertical or a horizontal break. For example, suppose that the chocolate bar is 2 x 2. The first split makes two pieces, both 2x1. Each of these pieces requires one more split to form single squares. This gives a total of three splits. Use strong induction to conclude : To divide up a chocolate bar with m x n squares, we need at most mn - 1 splits. Hint: Use strong induction on k, the number of squares in the chocolate bar (k = mn). 19PW17

Additional Problems

1. Prove by mathematical induction 1.2.3+2.3.4+ .. n.(n+1).(n+2)=1/4.n.(n+1.(n+2).(n+3)
2. Find a formula for $\frac{1}{1.2}+\frac{1}{2.3}+\frac{1}{2.4}...+\frac{1}{n.(n+1)}$ by examining the values of this expression for small n. Prove the formula you conjectured.
3. Use M. I to prove the inequality $n < 2^n$ for every positive integer n.
4. What is a harmonic ? P. T $H_{2^n} \geq 1 + \frac{n}{2}$
5. P. T. $\overline{\bigcap_{j=1}^{n} A_j} = \bigcup_{j=1}^{n} \overline{A_j}$ where A_1, A_2 ..A_n are subsets of universal set and n >= 2.