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**ICS 2018 Problem Sheet #2**

Problem 2.1:

Proof by contrapositive (2 points) Let n be a natural number. If n is not divisible by 3, then n is also not divisible by 15.

**Theorem:** Let n be the natural number. If n is not divisible by 3 then n is also not divisible by 15.

**Proof:**

We prove Contrapositive.

If n is divisible by 15 then it is also divisible by 3.

Here,

If n is divisible by 15 then,

We have, where is an Integer.

or, (1)

Now from (1)

We have

(2)

Here we find 3 is a factor of number so,

We have

Therefore, it shows that n is divisible by 3 .

We proved that “If n is divisible by 15 then it is also divisible by 3” and thus its contrapositive

“If n is not divisible by 3, then n is also not divisible by 15.”

Problem 2.2:

Proof by induction

Let n be a natural number with n ≥ 1. Proof that the following holds:

Here,

**Induction Basis:**

Check Condition (1)

**S**1

**Induction Step:**

Assuming that Sn  is correct for a number m.

So we have,

Sm  (1)

To show that it is right for (m+1) term

**Induction Hypothesis:**

By construction, we know that,

S *(m+1)* =S*m* + *(m+1)th term*

*=* S*m* +

=

=

=

=

=

=

=

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=

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=

S (m+1) = = LHS proved

**Conclusion:**

By mathematical induction,

When S1 is true ⟹ S2 is true

S2 is true ⟹ S3 is true

………………………………..

Sn istrue ⟹ Sn+1 istrue