CSE547
Ch3. Problem 14

Problem 14 Solution

- <u>Problem Description</u>

Prove or disprove

(x mod ny) mod y = x mod y, for all integer n

Prove or disprove
(x mod ny) mod y = x mod y, for all integer n

- <u>Problem Solusion</u>

Let x mod y = p, where $|p|<|y|$ and p is an integer

According to the definition of “mod”, there exists an integer m such that

$$x = my + p \quad \text{---- Equation 1}$$

Prove or disprove
$(x \bmod ny) \bmod y = x \bmod y$, for all integer n

- <u>Problem Solution</u>

Let $x \bmod ny = q$, where $|q|<|ny|$ and q is an integer

According to the definition of "mod", there exists an integer t such that

$$\mathbf{x = t(ny) + q} \quad \text{---- Equation 2}$$

Prove or disprove
(x mod ny) mod y = x mod y, for all integer n

- <u>Problem Solution</u>

Now, we try to prove the equation:

(x mod ny) mod y = x mod y, for all integer n

Prove or disprove
(x mod ny) mod y = x mod y, for all integer n

- <u>Problem Solution</u>

We know that

x mod y = p (Equation 1)

What is the value of **(x mod ny) mod y**?

Prove or disprove
(x mod ny) mod y = x mod y, for all integer n

- <u>Problem Solution</u>

$x = my + p$ ($|p|<|y|$) (Equation 1)

$x = tny + q$ ($|q|<|ny|$) (Equation 2)

$$\mathbf{q} = x - tny \qquad \text{(Equation 2)}$$

$$= my + p - tny \qquad \text{(Equation 1)}$$

$$= (m-nt)y + p$$

Prove or disprove

(x mod ny) mod y = x mod y, for all integer n

- <u>Problem Solution</u>

Thus we get

$$q= (m-nt)y + p$$

(m-nt) is an integer, and |p|<|y|, so we have

$$q \bmod y = p$$

(x mod ny) = q (Assumption)

(x mod ny) mod y = q mod y (Assumption)

= p

Prove or disprove
(x mod ny) mod y = x mod y, for all integer n

- <u>Problem Solution</u>

According to our assumptions, we have proved

1) (x mod ny) mod y = p

2) x mod y = p

Hence we proved

(x mod ny) mod y = x mod y ,for all integer n