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**BSD 2201 - NETWORK SCIENCE THEORY**

**ASSIGNMENT 3**

Explicitly discuss the Congruence Class Model. (10 Marks)

The Congruence Class Model is a mathematical concept used to investigate modular arithmetic, which is concerned with arithmetic operations on integers having a defined modulus. In this concept, all the integers that have the same remainder when divided by the modulus are classified into sets known as congruence classes.

Theoretically, the set of numbers that divide by m with the same remainder as an integer is defined as the congruence class modulo m of that integer if m is a positive integer.

Given by [a] = b in Z | b = a + km for some integer k, this set is denoted by [a] or [a] mod m.

For instance, since all of these integers have the same residual of 3 when divided by 7, the congruence class of 3 modulo 7 is [3] =...-11, -4, 3, 10, 17,

Z/mZ or Zm stands for the set of all congruence classes modulo m, and it consists of m different elements. For instance, there are seven congruence classes in the set Z/7Z = [0], [1], [2], [3], [4], [5], [6]—one for each potential remainder when dividing by 7.

Arithmetic operations are carried out on congruence classes in the congruence class model rather than on discrete integers. For instance, we may simply take any two integers from the congruence classes [a] and [b], and then compute the sum of x and y. [a+b] is the congruence class that results, since all integers in this class have a remainder of a+b when divided by m.

Similar to this, to multiply the two congruence classes [a] and [b], we select any integers from [a] and [b] for x and y, respectively, and then compute the product xy. As all integers in this class have a remainder of a\*b when divided by m, the resulting congruence class is [ab].

Many applications of the congruence class concept exist in number theory, algebra, cryptography, and computer science. Finding solutions to linear congruence, computing modular inverses, and determining the primarily of huge integers are just a few applications that can be made of it.

**References:**

Rosen, K. H. (2019). Elementary number theory and its applications. Pearson.

Ireland, K., & Rosen, M. (2013). A classical introduction to modern number theory. Springer.

Hardy, G. H., & Wright, E. M. (2008). An introduction to the theory of numbers. Oxford University Press.