

# Assignment 9

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Download codes from

<https://github.com/KUSUMAPRIYAPULAVARTY/assignment9>

as a linear combination of system of equations in (2.0.1),(2.0.2)

Hence those two systems are equivalent.

## 1 QUESTION

Prove that if two homogenous systems of linear equations in two unknowns have the same solutions, then they are equivalent.

## 2 SOLUTION

Let the two systems of homogenous equations be

$$A_{11}x_1 + A_{12}x_2 = 0 \quad (2.0.1)$$

$$A_{21}x_1 + A_{22}x_2 = 0 \quad (2.0.2)$$

$$\text{and } B_{11}x_1 + B_{12}x_2 = 0 \quad (2.0.3)$$

$$B_{21}x_1 + B_{22}x_2 = 0 \quad (2.0.4)$$

where  $A_{11}, A_{12}, A_{21}, A_{22}, B_{11}, B_{12}, B_{21}, B_{22}$  are elements of a field  $F$

The linear combination of equations for the system represented in (2.0.1),(2.0.2) can be given as

$$(c_1A_{11} + c_2A_{21})x_1 + (c_1A_{12} + c_2A_{22})x_2 = 0 \quad (2.0.5)$$

where  $c_1, c_2$  are scalars in field  $F$

The solutions to a system of linear equations also satisfy the linear combinations of those system of equations.

So, (2.0.5) and system of equations in (2.0.3) and (2.0.4) also have the same set of solutions.

From this we can write,

$$c_1A_{11} + c_2A_{21} = B_{11}, c_1A_{12} + c_2A_{22} = B_{12} \quad (2.0.6)$$

for a particular value of  $c_1, c_2$  in  $F$  and

$$c_1A_{11} + c_2A_{21} = B_{21}, c_1A_{12} + c_2A_{22} = B_{22} \quad (2.0.7)$$

for another value of  $c_1, c_2$  in  $F$

So, every equation in system of equations represented by (2.0.3) and (2.0.4) can be represented