DSMA (M2021) EndSem – Group 3 – 20 Marks

1. (a) [3 Marks] Solve the following recurrence relation:

$S_{n+2} - 10S_{n+1} + 21S_n = 3n^2 - 2$ for $n \geq 0$

(b) [2+2 Marks] Let S be given by span{[1,1,0],[0,1,1]}.

Find orthonormal basis of S and $S^{\perp}$ (orthogonal complement of S). [Span{x,y} indicates the space spanned by x and y]

2. [3 Marks] Let A={1,2,3,6,12,15,36} and R be the partial ordering on A defined by aRb if a divides b.

(a) Determine the relational matrix(zero one matrix) for R

(b) Draw the Hasse diagram of the poset (A, R)

(c) Find its maximal, minimal elements. Is there a greatest and a least element?

3. [3 Marks] Let R be a relation on A = {1,2,3,4,5,6,7,8,9,10} defined by xRy if and only if $(x - y)$ is a multiple of 4.

(a) Verify whether R is an equivalence relation on A

(b) Determine the equivalence classes and partition of A induced by R

4.(a)[3 Marks] Find null space for the matrix A given below. Employ Gaussian elimination. Clearly show your steps.

$$A = \begin{bmatrix} 2 & 1 & -1 \\ 1 & 1 & 4 \end{bmatrix}$$

(b) [4 Marks] Find projection matrix to project a vector onto the orthogonal complement of the left null space of A.

$$A = \begin{bmatrix} 2 & 3 \\ 1 & 2 \\ -1 & 3 \end{bmatrix}$$

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