

## Socrative, 2020-03-23 Afternoon

### Question 1

We have a set of 5 numbers:  $A = \{1, 2, 3, 4, 5\}$ . Let  $R$  be a binary relation on  $A$  such that  $aRb$  iff  $|a - b| = 1$  (namely, the distance between the numbers  $a$  and  $b$  is exactly 1 – both numbers are next to each other). The matrix of this relation is shown in the figure.

$$M_R = \begin{pmatrix} 0 & 1 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 \end{pmatrix}$$

Now consider the 2nd power of the relation  $R$ :  $R^2$ . How many 1's are there in the matrix of  $R^2$ ?

### Question 2

Consider the following binary relation  $R$  in a set of 4 elements that is defined by the following matrix:

$$M_R = \begin{pmatrix} 0 & 0 & 0 & 1 \\ 1 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \end{pmatrix}$$

How many 1's are there in the transitive closure  $R^*$ ?

### Question 3

Hasse diagram showing the divisibility relations for numbers  $\{0, 1, \dots, 9\}$  is shown in the figure. What is the total number of valid divisibility relations in this set? In other words, how many links you get, if you compute transitive closure of this Hasse diagram (and also add a reflexive loop from each number to itself, except 0 does not have a loop to itself).