

# BM20A9200 Mathematics A – Exercise set 11

To be done by 27.11.–1.12.2023

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Text in blue or red is not part of the problem or its solution. It's there as extra information to help you learn.

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**Exercise 1.** a) Of the two numbers 3515215 and 1535450, which are divisible by 9 and/or 11? Do not use a calculator. Remember to show your reasoning!

b) Of the following 3 calculations two of them have a mistake. Which two?

$$\begin{aligned} &485\,845\,416\,843\,583 \cdot 5\,414\,518\,454\,648\,546\,841 \\ &= 2\,630\,618\,975\,615\,996\,095\,288\,915\,945\,771\,302 \\ &8\,435\,485\,486\,753\,254 \cdot 52\,455\,421\,515 \\ &= 442\,486\,946\,891\,306\,887\,367\,859\,810 \\ &99\,999\,999\,999\,999\,999 \cdot 999\,999\,999\,989\,999\,999 \\ &= 99\,999\,999\,998\,999\,999\,999\,000\,000\,000\,010\,000\,001 \end{aligned}$$

**Exercise 2.**

a) Is there a multiplicative inverse of 7 modulo 12? If yes, calculate it.

b) Is there a multiplicative inverse of 6 modulo 8? If yes, calculate it.

**Exercise 3.** Let

$$\mathbf{A} = \begin{bmatrix} 1 & 2 & 6 \\ 2 & 0 & 1 \end{bmatrix}, \quad \mathbf{B} = \begin{bmatrix} 2 & 2 & 5 \\ 3 & -1 & 6 \end{bmatrix}, \quad \mathbf{C} = \begin{bmatrix} 4 & -2 \\ 6 & -2 \\ 6 & 1 \end{bmatrix}$$

Calculate

a)  $\mathbf{A}^\top$ ,  $\mathbf{B}^\top$  and  $\mathbf{C}^\top$ ,

b)  $\mathbf{A} + \mathbf{B}$  and  $\mathbf{A} - \mathbf{C}$ , and

c)  $\mathbf{AC}$  and  $\mathbf{CA}$ .

**Exercise 4.** Recall Exercise 1 of Assignment 3.

Let  $X = \{4, 5, 6\}$ ,  $Y = \{a, b, c\}$  and  $Z = \{l, m, n\}$ . Consider the relations  $R$  from  $X$  to  $Y$  and  $S$  from  $Y$  to  $Z$  defined by:

$$\begin{aligned} R &= \{(4, a), (5, b), (5, c), (6, b), (6, c)\}, \\ S &= \{(a, l), (a, m), (b, l), (b, m), (b, n), (c, m), (c, n)\}. \end{aligned}$$

Find the following compositions of relations using **boolean matrices**

a)  $RS$

b)  $RR^{-1}$

**Exercise 5.** For the following system of equations convert the system into an augmented matrix and use the Gaussian elimination method to find a solutions.

$$\begin{aligned}7x - 8y &= -12 \\ -4x + 2y &= 3\end{aligned}$$

**Exercise 6.** Find the inverse of the  $2 \times 2$ -matrix

$$\begin{bmatrix} 3 & -6 \\ 6 & 23 \end{bmatrix}.$$