Exercise for Constraint-based Modeling of Cellular Networks
27 October 2022

Exercise should be sent to Anika Küken (ankueken@uni-potsdam.de) by 3.11.2022

Exercises

1. Repetition matrix transformation and indexing

For the matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$, write the sequence of elementary row operations (lecture 1, slide 28) in the form of MATLAB commands that can put the matrix A into a reduced echelon form. Also, try the *rref()* function.

2. Solving linear problems

A store has requested a manufacturer to produce pants and sports jackets.

For materials, the manufacturer has 750m^2 of cotton textile and 1000m^2 of polyester. Every pair of pants (1 unit) needs 1m^2 of cotton and 2m^2 of polyester. Every jacket needs 1.5m^2 of cotton and 1m^2 of polyester. The price of the pants is fixed at 50€ and the jacket 40€. What is the number of pants and jackets that the manufacturer must give to the stores so that these items obtain a maximum sale?

a. Write down the LP model of the problem above in standard form.
b. Use the graphical method to solve the LP.
c. Use *linprog()* function in MATLAB to solve the LP.

Homework

1. (10 points)
   Maria has an online shop where she sells hand made paintings and cards. She sells the painting for 50€ and the card for 20€. It takes her 2 hours to complete one painting and 30 minutes to make a single card. She also has a day job and makes paintings and cards in her free time. Thus, she cannot spend more than 15 hours a week to make paintings and cards. Additionally, she should make not more than 10 paintings and cards per week. She makes a profit of 25€ on paintings and 15€ on each card. How many paintings and cards should she make each week to maximize her profit?
   a. Write down the LP model
   b. Use the graphical method to find the number of painting and cards that maximize Marias profit. What is the maximum profit Maria can achieve? Create a MATLAB figure showing the solution of the graphical method.
   c. Use linprog() function in MATLAB to check the solution for point b.

2. (5 points)
   Given subspace *W*, spanned by the vectors V={[1 2 3]^T,[0 2 1]^T,[1 1 1]^T}
   a. Is vector $b = [4\ 3\ 1]^T$ in subspace *W*?
   b. Is *V* a basis for subspace *W*?
   c. Form a matrix A, with its columns corresponding to the vectors in V, and then use appropriate MATLAB functions to confirm that the equation dim($col(A)$)+dim($N(A)$)=$number\ of\ columns\ in\ A$ holds for this matrix. (hint: dim($col(A)$) is equal to the number of pivots in the reduced echelon form of the matrix)