Exercise for

Constraint-based Modeling of Cellular Networks

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Exercise should be sent to (philipp.wendering@uni-potsdam.de) by 10.11.2020

Exercises for class

1. For the matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$, write the sequence of elementary row operations in the form of MATLAB commands that can put the matrix A into a reduced echelon form. Also, try the rref function of MATLAB to confirm your result.
2. Consider a chocolate manufacturing company which produces only two types of chocolate – A and B. Both the chocolates require Milk and Choco only. To manufacture each unit of A and B, following quantities are required:

   Each unit of A requires 3 unit of Milk and 2 units of Choco

   Each unit of B requires 3 unit of Milk and 4 units of Choco

   The company kitchen has a total of 120 units of Milk and 150 units of Choco. On each sale, the company makes a profit of

   10 per unit A sold

   12 per unit B sold.

   Now, the company wishes to maximize its profit. How many units of A and B should it produce respectively? (use the graphical method)

3. Use linprog function in MATLAB to solve the LP model in the exercise 2.

   ```
   [x,fval] = linprog(f,A,b,Aeq,beq,lb,ub)
   ```

Homework

1. Show that $(AB)^T = B^T.A^T$.
2. A school is preparing a trip for 400 students. The company who is providing the transportation has 10 buses of 50 seats each and 8 buses of 40 seats, but only has 9 drivers available. The rental cost for a large bus is 800 and 600 for the small bus. Use the graphical method to calculate how many buses of each type should be used for the trip for the least possible cost.
3. Use linprog function in MATLAB to check the solution for the second homework.
4. Working within the vector space $\mathbb{R}^3$, determine if $b = [4\ 3\ 1]^T$ is in the subspace W, spanned by the vectors $V = \{[3\ 2\ 3]^T, [1\ 0\ 3]^T, [1\ 1\ 0]^T, [2\ 1\ 3]^T\}$. Form a matrix A, with its columns corresponding to the vectors in V, and then use appropriate MATLAB functions to confirm that the equation $\dim\big(col(A)\big) + \dim\big(N(A)\big) = number\ of\ columns\ in\ A$ holds for this matrix. (hint: $\dim\big(col(A)\big)$ is equal to the number of pivots in the reduced echelon form of the matrix)