

1	2	3	4	Σ (7)

Assignment 5

(Handed in 16. November 2015)

Theoretical Assignment - *Comparison with at most l mismatches*

General we are now only looking at the worst case scenario, which means uniform distributed mismatches in an alignment. Also we only look at $k \geq 1$, as $k = 0$ is in our application not a useful result. Assume two sequences of length t with l mismatches.

Then both sequences contain l tuples of length $L = \lfloor \frac{t}{l+1} \rfloor$ and one tuple which has a length of maximal $\lfloor \frac{t}{l+1} \rfloor$.

So both sequences share l or $l + 1$ k -tuples, if $k = \lfloor \frac{t}{l+1} \rfloor$, and for each $k \leq \lfloor \frac{t}{l+1} \rfloor$ they share $(l + 1) * \lfloor \frac{k}{l} \rfloor$ k -tuples.

Theoretical Assignment - *Linear programming by hand*

The feasible region of this linear program is shown in figure 1, where the red line is constraint 1, green line is constraint 2, constraint 3 is drawn as a blue line and the yellow line is constraint 4.

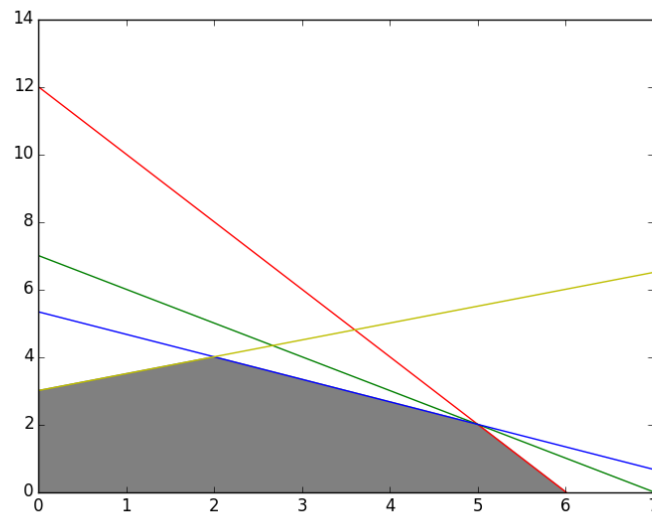


Figure 1: feasible region of linear program (grey area)

solution if t=s=1

Generally we only used integers in this task. The constraint for the algorithm are as following if t and s value is 1 now:

$$\max : 1 * x_1 + 1 * x_2 \quad (1)$$

$$2 * x_1 + x_2 \leq 12 \quad (2)$$

$$2 * x_1 + 3 * x_2 \leq 7 \quad (3)$$

$$-1 * x_1 + 2 * x_2 \leq 16 \quad (4)$$

$$x_1, x_2 \geq 0 \quad (5)$$

the next step we started to compute each line of the tuple. Starting with constraint 3 under the aspect of constraint 5. All possible tuples respectively to both constraints from the assignment are:

$$temp1 = \{(0, 7); (1, 6); (2, 5); (3, 4); (4, 3); (5, 2); (6, 1); (7, 0)\}$$

the constraint 2 was applied to temp1:

$$temp2 = \{(0, 7); (1, 6); (2, 5); (3, 4); (4, 3); (5, 2); \}$$

the next constraint (constraint 4) was applied:

$$temp3 = \{(5, 2)\}$$

but not least the last constraint (4) is checked and the remaining tuple from the last step is valid:
 $r = \{(5, 2)\}$

the final result for the Algorithm with s=t=1 is the tuple: (5,2). Solving the formula with this numbers leads us to the following maximal value: $1 * x_1 + 1 * x_2 = 5 + 2 = 7$

How to make unsolvable?

To get a not solvable algorithm for example the following constraint could be added:

$$x_1 + x_2 \geq 7 \quad (6)$$

a new constraint just needs to be a contradiction to another constraint.

How to get infinite solutions with t and s?

The equation influence by t and s is:

$$\max : s * x_1 + t * x_2$$

way to get an infinite solution could be to generate a endless loop with values for s and t like:

$$s = s * x_1$$

$$t = t * x_2$$

or

$$s = t * x_2$$

$$t = s * x_1$$

idea of the evening: Do not assume to only use integers! Another variant is to define:

$$s = \frac{1}{x_1}$$

$$t = \frac{1}{x_2}$$

the result for Z now is 2 and there are infinite many possibilities to get to 2.

how to get the points?

P1=(0,3)

P2=(2,4)

P3=(1,3)

P4=(6,0)

Theoretical Assignment - *Bonus: Carillo-Lipman bound*