Bioinformatics I
WS 15/16
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1	2	3	4	$\sum$ (7)

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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 mistmatches in an alignment. Also we only look at $k >= 1$, as $k = 0$ is in our application not a useful result. Assume two sequences of length t with l mismatches.
Than both sequences contain l tuples of length $\lfloor \frac{t}{l+1} \rfloor$ and one tuple which has a length of maximal $\lfloor \frac{t}{l+1} \rfloor$. Where $k = \lfloor \frac{t}{l+1} \rfloor$ is the maximal tuple length, possible in sequences.

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

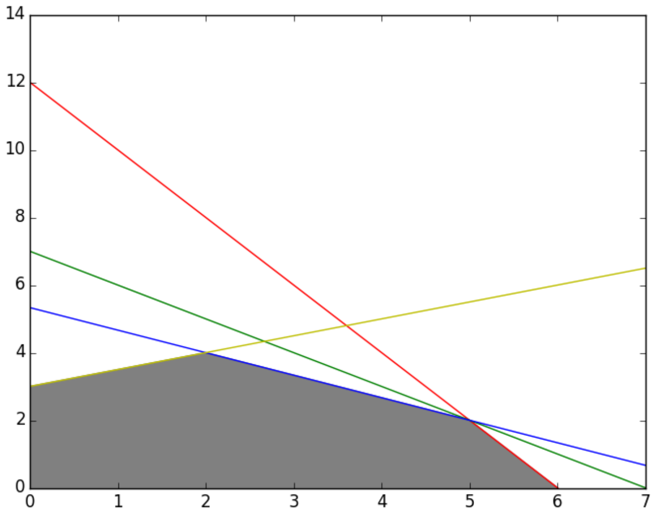

Figure 1: feasible region of linear program (grey area)

solution if t=s=1

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

$$max: 1 * x_1 + 1 * x_2 \quad (1)$$
$$2 * x_1 + x_2 \leq 12 \quad (2)$$
$$2 * x_1 + 3 * x_2 \leq 7 \quad (3)$$
$$-1 * x_1 + 2 * x_2 \leq 16 \quad (4)$$
$$x_1, x_2 \geq 0 \quad (5)$$

In 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 respectivly to both constraints from the assignment are:
$temp1 = \{(0,7); (1,6); (2,5); (3,4); (4,3); (5,2); (6,1); (7,0)\}$

Next the constraint 2 was applied to temp1:
$temp2 = \{(0,7); (1,6); (2,5); (3,4); (4,3); (5,2); \}$

Again the next constraint (contraint 4) was applied:
$temp3 = \{(5,2)\}$

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

So the final result for the Algorithm with s=t=1 is the Dupel: (5,2).

How to make unsolveable?

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

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

Generally 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:

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

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

$$s = s * x_1$$
$$t = t * x_2$$
$$or$$
$$s = t * x_2$$
$$t = s * x_1$$

Best 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*