Homework #2
Due Wednesday, January 30

1. Use Maple and Lawrence's method to determine the volume polynomial for the "tent" with vertices

$$\begin{aligned} p_1 &= (0,0,0)\\ p_2 &= (2,0,0)\\ p_3 &= (2,6,0)\\ p_4 &= (0,6,0)\\ p_5 &= (1,2,2)\\ p_6 &= (1,4,2) \end{aligned}$$

   and facets

$$\begin{array}{ll} F_1: & -x_3 \le 0\\ F_2: & 2x_1 + x_3 \le 4\\ F_3: & \frac{1}{2}x_2 + \frac{1}{2}x_3 \le 3\\ F_4: & -2x_1 + x_3 \le 0\\ F_5: & -\frac{1}{2}x_2 + \frac{1}{2}x_3 \le 0 \end{array}$$

   Note that this polytope already sits in the nonnegative octant. Take the determinant of each basis to be positive. Use a generic objective function of $c_1x_1+c_2x_2+c_3x_3$—if all goes well, no indeterminate c_i will appear in the volume polynomial, which should be a polynomial in the variables $b_1, \ldots, b_5$. Observe that every monomial that appears in the polynomial is supported by a subset of variables b_i which corresponds to a subset of facets with nonempty intersection.

2. Exercise 3.3.

3. Exercise 3.7.

4. Exercise 3.8.

5. Exercise 3.9.

6. Exercise 3.15.