

## WEEK 10, TUTORIAL 9: SENSITIVITY ANALYSIS

### Components in an LP problem may change

- eg.
- production costs
  - availability of resources
  - value of goods

Some changes are structural...

(new variable, elimination of some constraints,  $\leq$  to  $\geq$ )

... and others are parametric

(changes in  $A, b, c$ )

So, we can change LP models in two ways

#### 1) STRUCTURAL CHANGES

- add/remove decision variables (change in  $n$ )
- add/remove constraints (change in  $m$ )

#### 2) PARAMETRIC CHANGES

- change in obj. function coefficients (c)
  - change in RHS values (b)
  - change in coefficient matrix (A)
- } from initial problem  
ie initial tableau

Investigation of how parametric changes affect the optimal solution is called **SENSITIVITY ANALYSIS**

KEY OBSERVATION (max problem)

A Simplex tableau is optimal IF AND ONLY IF each constraint has a non-negative RHS and each variable has non-negative coefficient in the z-row

After changes in parameters we have the following possibilities:

- ① old optimal solution remains optimal
- ② old optimal solution remains feasible but not optimal
  - (i) old basis remains
  - (ii) change in basis

\* CHANGES IN COMPONENTS OF THE  $C$  VECTOR (OBJECTIVE  $F^m$ )

DO NOT AFFECT FEASIBILITY

so: will the old optimal solution still be optimal?

→ check new reduced costs of non-basic variables

- for opt = max need  $RC \geq 0$
- for opt = min need  $RC \leq 0$

if **NO** we need to find the new optimal sol<sup>n</sup>

\* CHANGES IN COMPONENTS OF  $b$  (RHS)

HAVE NO EFFECT ON REDUCED COSTS

so: will the old optimal solution still be feasible?

→ consider the new RHS values:

if one or more are negative then the old optimal solution is infeasible

OTHERWISE

the new optimal solution has the same basis and the new optimal values are given by the new RHS