Sensitivity analysis involves understanding how changes in input parameters affect the optimal solution.

Slack Variables

* Definition: A slack variable is added to a less than or equal to constraint to convert it into an equality.
* Economic Interpretation: A slack variable represents the unused or idle capacity of a resource. It quantifies the amount by which a resource is underutilized.

Surplus Variables

* Definition: A surplus variable is subtracted from a greater than or equal to constraint to convert it into an equality.
* Economic Interpretation: A surplus variable represents the excess or over-utilization of a resource. It quantifies the amount by which a resource is used beyond the required level.

What is a Shadow Price?

* Imagine you're running a factory that produces toys. You have limited resources like plastic, labour, and machine hours. You've optimized your production to maximize profit. Now, what if you could magically get one extra hour of machine time? How much extra profit could you generate?
* That extra profit you could earn from gaining one more unit of a constrained resource is called the shadow price. It's the implicit value or worth of that resource in the context of your optimization problem.

**Shadow Price** (also known as the **dual value** or **dual price**) is a concept in linear programming that refers to the rate of change in the optimal value of the objective function with respect to a marginal change in the right-hand side (RHS) of a constraint, while keeping all other data unchanged.

Continuous Setting: In a continuous setting, it's possible to make infinitesimally small changes to a variable. This allows for the calculation of derivatives and marginal values, which are essential for determining shadow prices.

Discrete Setting: In a discrete setting, changes are restricted to whole units. There's no concept of a "tiny" change in a variable. As a result, the mathematical tools used to calculate marginal values in continuous settings are not directly applicable.