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# 🐰 Easter Egg Optimisation Model 🐰

## Model Summary

## Sets and Indices

* Let be the index for children
* Let be the index for egg types
* Let be the index for households

## Parameters

* : enjoyment score of egg type
* : basket capacity for child (max number of eggs they can carry)
* : effective time for child
* : available supply of egg type
* : fairness threshold for household (maximum allowed difference in total eggs between any two children in the same household)
* : minimum required enjoyment score

## Decision Variables

* : number of eggs of type collected by child

## Objective Function:

Maximise total egg enjoyment:

## Subject to Constraints:

### 🔢 Non-negativity and Integrality:

Constraint: No negative or half eggs can be collected.

💡 Use case: Ensures realistic egg counts.

### 🧺 Basket Capacity (Knapsack):

Constraint: Children can only carry as many eggs as their basket allows

💡 Use case: Prevents overloading children’s baskets.

### ⏱️ Time Limit:

Constraint: Children can only collect eggs within their effective time limit.

💡 Use case: Ensures children don’t exceed their time limit for collecting eggs.

### 🥚 Egg Supply Limits:

Constraint: The Easter Bunny only has a certain number of eggs.

💡 Use case: Ensures the total number of eggs collected does not exceed the available supply.

### ⚖️ Fairness Constraint:

Constraint: Ensure the difference in total eggs collected by any two children in the same household is within the fairness threshold.

💡 Use case: Ensures fairness among children in the same household.

### 🎯 Prioritization / Personal Preference

Constraint: Some children prefer certain types of eggs (e.g., healthier or chocolatey ones).

Where is the maximum preference weight (e.g., Child 3 doesn’t like chocolate, so ).

💡 Use case: Encourages personalisation or diet-based optimisation.

### 📈 Minimum Enjoyment Threshold

Constraint: Ensure each child collects a minimum enjoyment value.

Where is enjoyment score, and is a required level.

💡 Use case: Prevents over-optimisation for value alone—adds fun balance.