Advanced Scheduling Systems

Exam Project

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1 Problem Description: input and output

The addressed problem revolves around a production issue.
The model takes as input n lines,and m orders which have to be fulfilled. Each order is further divided into k operations (Opr), each spanning a single day.
Every order is associated with: a specific category (denoted by a numerical value), a minimum start and a maximum end dates.
The output format to represent this problem takes the form of a matrix. In this matrix, rows correspond to orders, columns represent days, and the matrix cells contain the line number to which the operation is assigned. Within each row of the matrix, the number of cells to be populated should match the total number of operations for the corresponding order.

2 Initial State, Move's Attributes and Cost Components

In the initial state, a number of cells corresponding to the duration in days of each order are allocated in each row. This allocation ensures a consistent adherence to demand constraints.
The move selects a cell and changes the line and/or day. The attributes of this move are: the order, the operation, the old day, the new day,the old line, and the new line.
Specifically, to progress through the moves, the sequence involves altering the line first, followed by the day, then the operation, and finally the order.
The are 5 cost components: 1) Delay: This represents a hard constraint, taking into account the sum of delay days for each operation of each order, relative to the maximum end date of the order.
2) Advance: Similarly, a hard constraint, it considers the sum of advance days for each operation of each order, relative to the minimum start date of the order.

3) LineOverload: This component considers the fact that each line can handle only one operation per day, thus it's a hard constraint which requires that a single operation per line is assigned on a given day.
4) LinesToAOrder: This constitutes a soft constraint, encompassing learning costs. Specifically, a cost is incurred whenever different operations of an order are assigned to more than one line.
5) CategoryDeviation: This component aims to minimize the disparity between categories of orders allocated to the same line. This is particularly useful in scenarios where categories represent product types or paint colors. The proximity of category numbers implies, for example, greater similarity between products (favoring the assignment of similar products to the same line), or between paint colors, to prevent color contamination.

3 Data Structures

To provide greater clarity, the following section will present an example showing the data structures employed, including the redundant ones, to address the problem.

```
Lines = 2;
Orders = 3;
Categories = 2;

MinStartDays = [0, 1, 0];
MaxEndDays = [2, 3, 2];
OrdersDuration = [2, 1, 2];
OrdersSpecialisation = [0, 1, 0];
```

assign

	D0	D1	D2	D3
O0	0	1	-1	-1
O1	1	-1	-1	-1
O2	-1	1	0	-1

line_load

	D0	D1	D2	D3
L0	1	0	1	0
L1	1	2	0	0

operation_day

	Opr1	Opr2
O0	0	1
O1	0	
O2	1	2

number_of_opr_per_order_to_lines

	L0	L1
O0	1	1
O1	0	1
O2	1	1

category_deviation

	[0] (min)	[1] (max)
L0	0	0
L1	0	1

second_category_deviation

	[0] (min)	**[1]** (max)
L0	-1	-1
L1	1	0

number_of_opr_per_category_to_lines

	C0	**C1**
L0	2	0
L1	2	1

number_of_lines_for_a_order

O0	**O1**	**O2**
2	1	2