**OPTIMIZATION METHODS AND ALGORITHMS**

**PROBLEM FORMALIZATION**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | NOTATION: | Domain: | |  |
| 1 |  |  | | Student index |
| 2 |  |  | | Exam index |
| 3 |  |  | | Timeslot index |
| 4 |  |  | | Auxiliary timeslot index |
| 5 | *i* |  | | Difference between 2 timeslots indices |
|  |  |  | |  |
|  | **DATA:** |  | |  |
|  |  | Total number of students enrolled in at least 1 exam | | |
|  |  | Total number of exams | | |
|  |  | 1 if student *s*  is enrolled in exam *e*, 0 o/w | | |
|  |  | Number of available timeslots | | |
|  |  |  | |  |
|  | **VARIABLES:** |  | |  |
| 1 |  |  | | 1 if exam *e* is scheduled on timeslot *t*, 0 o/w |
| 2 |  |  | | Number of exams that student *s* has in a certain timeslot *t*. **NB: due to the constraint #3, the real domain of is {0,1}** |
| 3 |  |  | | 1 if student *s*  is occupied in both timeslots *t* and *t1*, 0 o/w |
|  |  |  | |  |
|  | **CONSTRAINTS:** |  | |  |
| 1 |  |  | | Each exam is scheduled in one and only one timeslot. |
| 2 |  |  | | zs,t is the number of exams that student *s* has in a certain timeslot t. |
| 3 |  |  | | Student *s* cannot be enrolled in more exams which are scheduled in the same timeslot, hence the sum of all exams in which student *s* is enrolled and which take place in timeslot *t* is 1 or 0. |
| 4 |  |  | | us,t,t1 represents a conflict : it is 1 if student *s*  is occupied in both timeslots *t* and *t1*, 0 o/w. |
|  |  |  | |  |
|  | **COST FUNCTION:** |  | | |
|  |  | | For a given distance *i* and a given timeslot *t*, we have a penalty that depends on the number of people occupied in both timeslots *t* and *t+i*. The penalty is 0 if *i*>5. | |
|  |  |  |  | |
|  | **OBJECTIVE FUNCTION:** |  | |  |
|  |  |  | | For each penalizing distance between timeslots we sum the penalty generated by each pair of timeslots which distance is *i*.  i.e. for each considered distance, we multiply the respective penalty by the number of students which are occupied both in timeslot *t* and *t*+*i* \*. This number of students is calculated by summing over all students the boolean variable which is 1 if student *s* is occupied in timeslots *t* and *t*+*i* and 0 o/w. |

\* We only consider the **subsequent** timeslots to avoid counting penalties twice.