## And-tree Search Model

For the model, Prob is defined as a vector of length |Courses + Labs|, whose elements consist of the indices of slots from Slots, or the unassigned symbol, $. The ordering of vector will be the same as the original ordering of Courses + Labs. Therefore, a Prob vector can be read sequentially as: Course/Lab at position $i$, having value $j$, has been assigned time slot $s_j$, where $s_j$ is the member $s$ of the set Slots at the $j^{th}$ index of Slots. As such, the definition of Prob is equivalent with the notion of a partial assignment, *partassgin*.

$D_i$, defined as the domain of any element in a problem instance, pr, to be the set: 0,...,$j$ where $j$ + 1 = |Slots|. With that, Prob is defined as follows:

Prob = <$C_1$slot,...,$C_n$slot,...,$L_{11}$slot,...,$L_{1k_1}$slot,...,$L_{n1}$slot,..,$L_{nk_n}$slot>
such that $C_i$slot, $L_{ik_i}$slot $\in D_i \cup \{\$\}$

Which can be abstracted into the form:

Prob = <$X_1$,...,$X_n$> such that $X_i \in D_i \cup \{\$\}$

The divide relation, Div, defined as:

Div = $\{((X_1, ..., X_i, ..., X_n), (X_1, ..., d_{i1}, ..., X_{in}), ..., (X_1, ...d_{il}, ..., X_n))$ |
$X_i = \$, 1 \leq i \leq n, |D_i| = l, D_i = \{d_i, ..., d_{il}\}\}$

"pr is solved" is defined as follows:

pr = $(X_1, ..., X_n)$ and $\forall i$ such that $1 \leq i \leq n$, $X_i \neq \$$, and pr is not unsolvable.

"pr is unsolvable" is defined as follows:

pr = $(X_1, ..., X_n)$ and there is a constraint $C_i = R_i(X_1, ..., X_k)$ such that $\exists X_{ij} \in$pr with a value unequal to $ and $(X_1, ..., X_k)$ do not satisfy $R_i$.

Since we have access to **Constr**$^*$, derived from the provided function, **Constr**, we can allow **Constr**$^*$ to perform the work of assessing whether any particular problem instance, pr, is compliant with the problem;s hard constraints.