GROUP 1

Alloy Project

CS4710

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1.0 - Problem Description

Our goal is to model a Sudoku program. Our program will take in number in a square and determine if the number in that square is valid. A square is defined by its specific row and column coordinate pair. Users will enter one number at a time, and that number will be verified before the user is allowed to make another move. Our model will be based off of a 9 row by 9 column board.

1.1 - Functionalities Provided

1. 9x9 board
    a. board cannot be bigger or smaller
    b. Valid values will be pre-generated at random to create a semi unique puzzle each time the user plays.
2. Valid Value Calculation
    a. The value that the user is entering into the current row cannot already be present in that row.
    b. The value that the user is entering into the current column cannot already be present in that column.
    c. The value that the user is entering into the current 3x3 square cannot already be present in that 3x3 square.
    d. a, b, and c must all be true in order for the user to make their next move
3. The following events will be reported to a user
    a. Invalid move
    b. Other errors

1.2 - Functionalities Excluded

1. Solving of the puzzle
    a. If users fills all squares puzzle will be correct since all moves are valid
    b. If user is unable to solve the puzzle a solution will not be provided to them.
2. Time limit
    a. users have unlimited time to solve the puzzle
3. Points system
    a. Points will not be tallied based on time or other criteria.

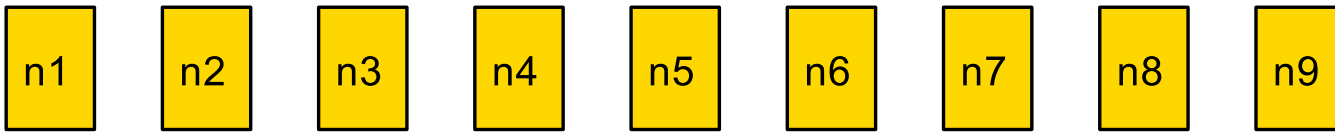
2.0 Abstraction

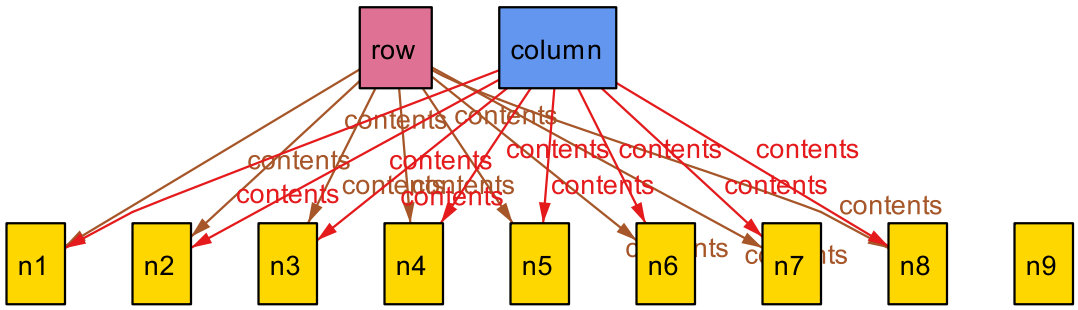
There was only one abstraction necessary in our project and that was the number sig. We chose to define “number” as abstract because a number can only be one of the nine defined numbers, n1-n9. Rather than defining n1-n9 separately we chose to define them as an extension of number because while they represent different numbers they are similar in structure and will all fit under the number sig.

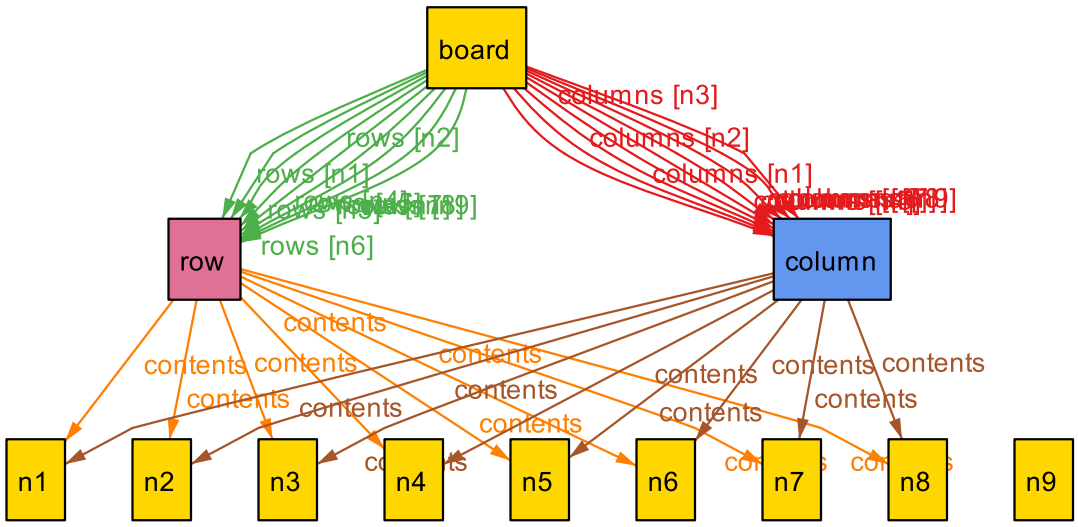
2.1 Relations and Multiplicities

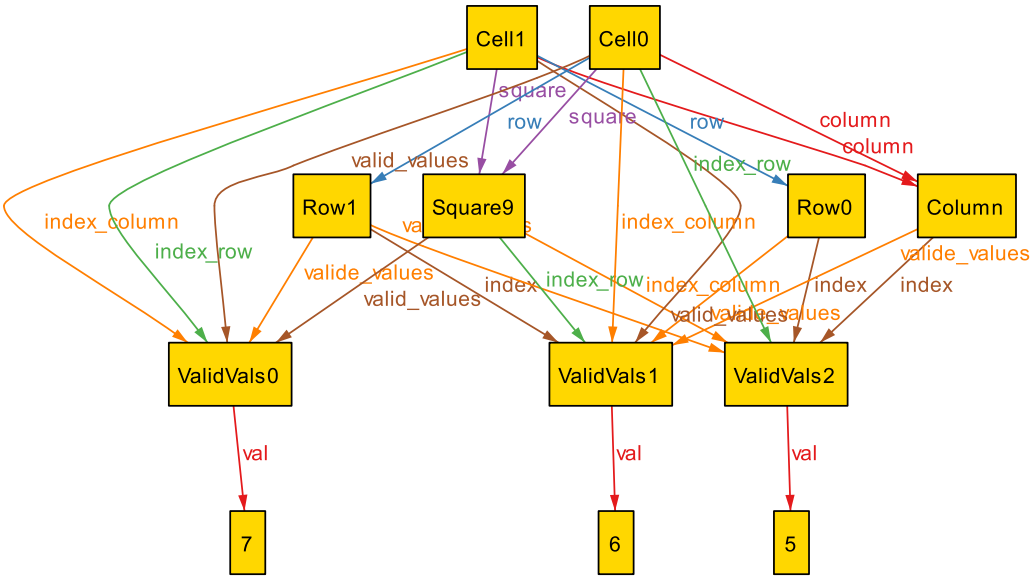
The abstract signature number is related to n1-n9 in that all nine of the row and column numbers are themselves a number. Each column, row, and square9 contains a set of nine numbers n1-n9 that represents the column number, row number and square number respectively. A cell also contains two numbers which will be referred to as I and j which represents the row the cell is in (I), and the column the cell is in (j). Each board is made up of set of 81 cells. Each board has a set of 9 rows, a set of 9 columns and a set of 9 square9's.

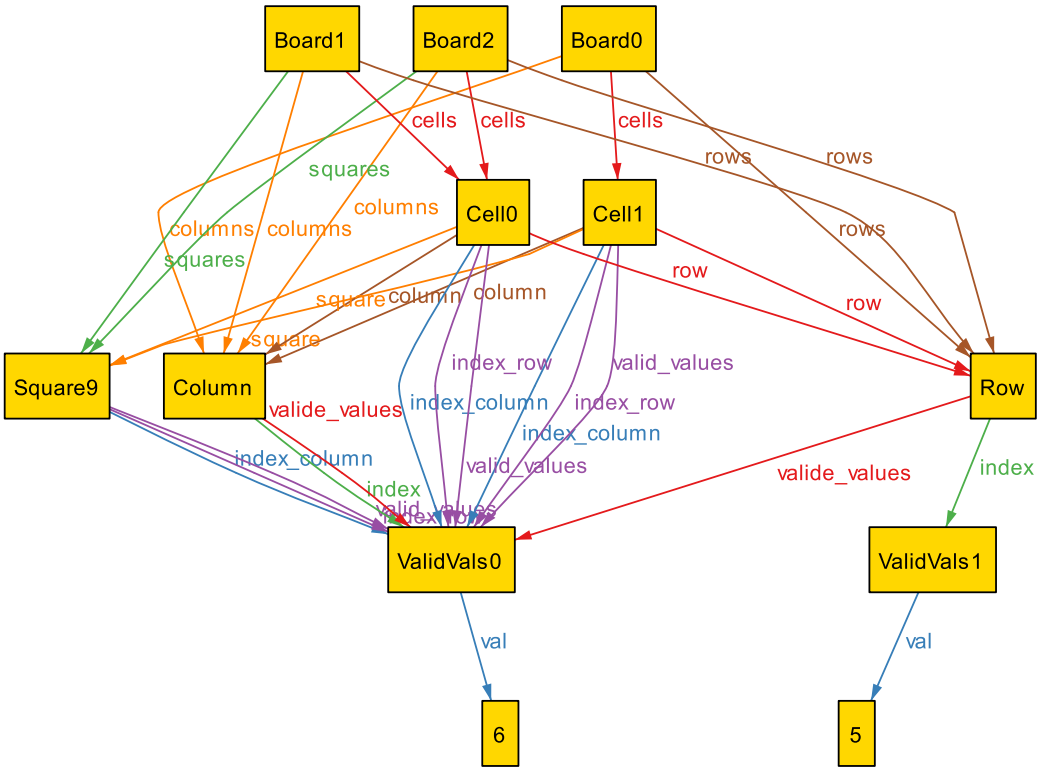
2.2 Model Creation Steps

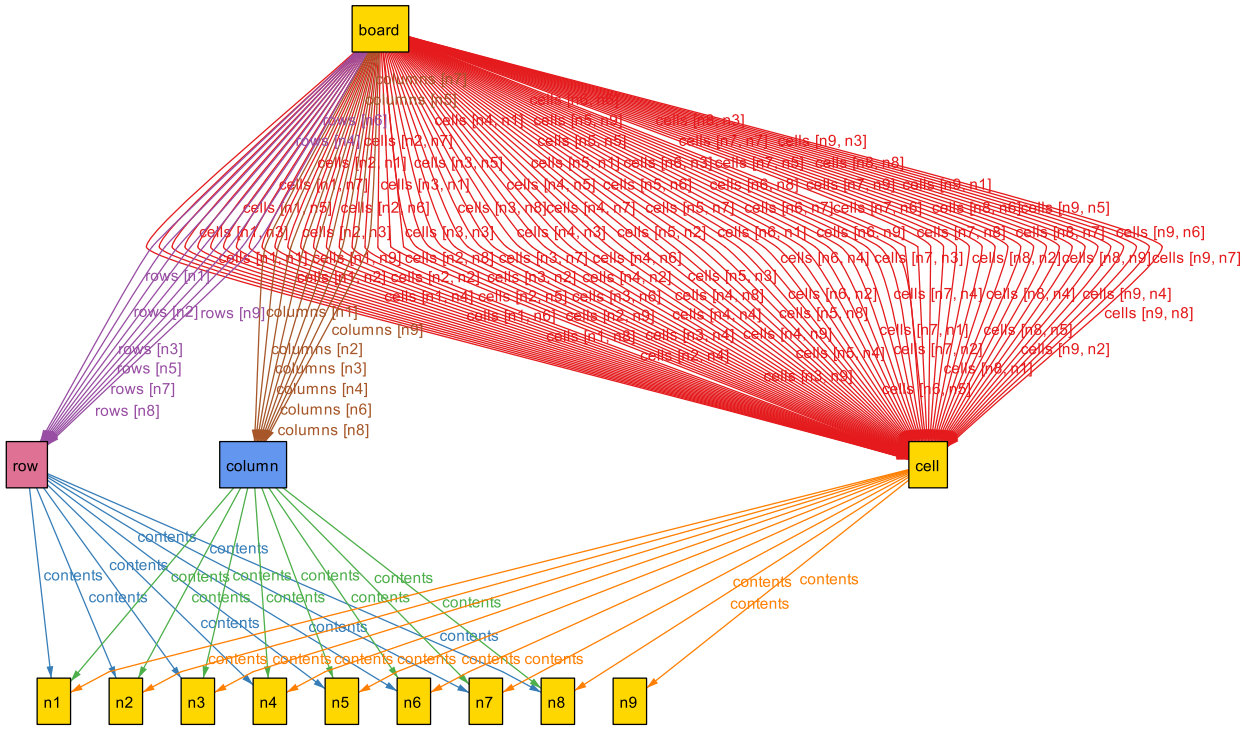

n1
n2
n3
n4
n5
n6
n7
n8
n9

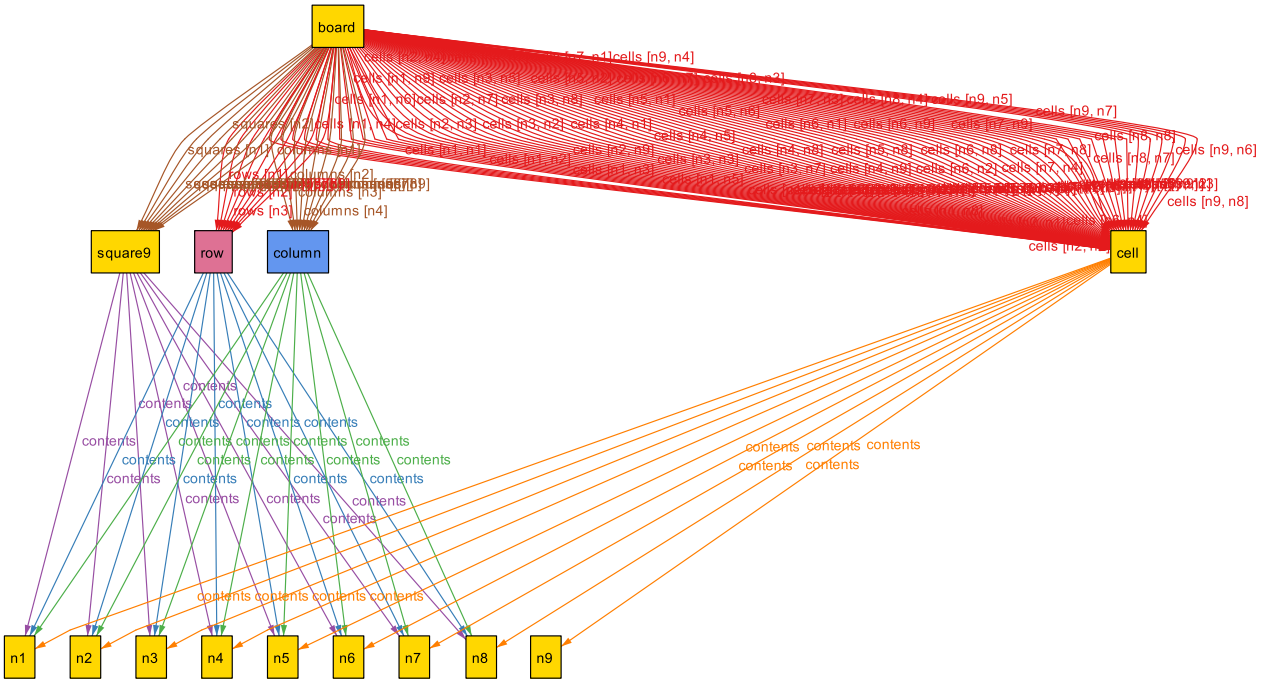

row
column
contents
n1
n2
n3
n4
n5
n6
n7
n8
n9


board
columns [n3]
columns [n2]
columns [n1]
rows [n2]
rows [n1]
rows [n6]
row
column
contents
n1
n2
n3
n4
n5
n6
n7
n8
n9


Cell1
Cell0
square
row
square
row
column
column
valid_values
index_row
Row1
Square9
Row0
Column
index_column
index_row
index_column
valide_values
valide_values
valid_values
index
index_row
index_column
index
index
ValidVals0
ValidVals1
ValidVals2
val
val
val
7
6
5


Board1
Board2
Board0
cells
cells
cells
rows
rows
rows
squares
columns
columns
columns
squares
Cell0
Cell1
row
row
square
column
column
square
Square9
Column
Row
index_row
valid_values
valide_values
index_column
index_row
index_column
index_column
valid_values
valide_values
index
index
valid_values
ValidVals0
ValidVals1
val
val
6
5


board
row
column
cell
n1
n2
n3
n4
n5
n6
n7
n8
n9
rows [n1]
rows [n2]
rows [n3]
rows [n5]
rows [n7]
rows [n8]
rows [n9]
columns [n1]
columns [n2]
columns [n3]
columns [n4]
columns [n6]
columns [n8]
columns [n9]
contents


board
square9
row
column
cell
cells [n9, n8]
cells [n9, n6]
cells [n9, n7]
cells [n9, n5]
cells [n8, n8]
cells [n8, n7]
rows [n3] columns [n4]
contents
n1
n2
n3
n4
n5
n6
n7
n8
n9