DEPARTAMENTO DE COMPUTACION

Facultad de Ciencias Exactas y Naturales - UBA

TP de Especificación

Sudoku

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Grupo 10

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1. Problemas

1. proc sudoku_esTableroValido (**in t**: $seq\langle seq\langle \mathbb{Z}\rangle\rangle$, **out result**: Bool) {

Pre {True}
Post {$tableroValido(t) = \textbf{result}$}
pred tableroValido (t: $seq\langle seq\langle \mathbb{Z}\rangle\rangle$) {
$esFilaValida(t) \wedge$ esColumnaValida(t)
}
pred esFilaValida (t: $seq\langle seq\langle \mathbb{Z}\rangle\rangle$) {
$(\forall i : \mathbb{Z})(\forall j : \mathbb{Z}) enRango(t, i) \wedge_L$
enRango(t[i],j) $\wedge_L$ length(t[i]) $= 9 \longrightarrow_L 0 \leq t[i][j] \leq 9$
}
pred esColumnaValida (t: $seq\langle seq\langle \mathbb{Z}\rangle\rangle$) {
$(\forall i : \mathbb{Z})(\forall j : \mathbb{Z}) length(t) = 9 \wedge$ enRango(t,i) $\wedge_L$
enRango(t[i],j) $\longrightarrow_L 0 \leq t[i][j] \leq 9$
}
}

2. proc sudoku_esCeldaVacia (**in t**: $seq\langle seq\langle \mathbb{Z}\rangle\rangle$, **in f**: $\mathbb{Z}$, **in c**: $\mathbb{Z}$, **out result**: Bool) {

Pre {$tableroValido(t) \wedge$
$0 \leq f, c \leq$}
Post {**result** $= celdaVacia(f, c) predceldaVacia\ (t : seq\langle seq\langle \mathbb{Z}\rangle\rangle, i : \mathbb{Z}, j : \mathbb{Z})\{s[i][j] = 0\}$
}
}

3. proc sudoku_nroDeCeldasVacias (**in t**: $seq\langle seq\langle \mathbb{Z}\rangle\rangle$, **out result** : $\mathbb{Z}$) {

Pre {$tableroValido(t)$}
Post {**result** $= nroCeldasVacias(t) fun\ nroCeldasVacias\ (s : seq\langle seq\langle \mathbb{Z}\rangle\rangle)\ : \mathbb{Z} =$
$(\forall i : \mathbb{Z})(\forall j : \mathbb{Z}) enRango(s, i) \wedge_L$ enRango(s[i],j) $\longrightarrow_L$
$\sum$ if $celdaVacia(s, i, j)$ then 1 else 0 fi ;
}
}

4. proc sudoku_primeraCeldaVaciaFila (**in t**: $seq\langle seq\langle \mathbb{Z}\rangle\rangle$, **out result** : $\mathbb{Z}$) {

Pre {$tableroValido(t)$}
Post {if $celdasVacias(t) = 0$ then -1 else $(\exists i : \mathbb{Z})(\exists j : \mathbb{Z})$**result** $= i \wedge$ enRango(t,i) $\wedge_L$ enRango(t[i],j) $\wedge_L$
celdaVacia(t,i,j) $\wedge$ menorFilaVacia (t,i) $\wedge$ menorColumnaDeLaFilaVacia(t,i,j)
pred menorFilaVacia (**t:** $seq\langle seq\langle \mathbb{Z}\rangle\rangle$, **i:** $\mathbb{Z}$) {
$(\forall f : \mathbb{Z})(\forall g : \mathbb{Z}) enRango(t, f) \wedge_L$ enRango(t[f],g)
$\longrightarrow_L$ celdaVacia(t,f,g) $\wedge$ f $\geq i$)}
pred menorColumnaDeLaFilaVacia (**t:** $seq\langle seq\langle \mathbb{Z}\rangle\rangle$, **i:** $\mathbb{Z}$, **j:** $\mathbb{Z}$) {
$(\forall g : \mathbb{Z}) enRango(t[i], g)$
$\longrightarrow_L$ celdaVacia(t,i,g) $\wedge$ g $\geq j$)}
fi }
}

5. proc sudoku_primeraCeldaVaciaColumna (**in t**: $seq\langle seq\langle \mathbb{Z}\rangle\rangle$, **out result** : $\mathbb{Z}$) {

Pre {$tableroValido(t)$}
Post {if $celdasVacias(t) = 0$ then -1 else $(\exists i : \mathbb{Z})(\exists j : \mathbb{Z})$**result** $= j \wedge$ enRango(t,i) $\wedge_L$ enRango(t[i],j) $\wedge_L$
celdaVacia(t,i,j) $\wedge$ menorFilaVacia (t,i) $\wedge$ menorColumnaDeLaFilaVacia(t,i,j) fi }
}

6. proc sudoku_valorEnCelda (**in t**: $seq\langle seq\langle \mathbb{Z}\rangle\rangle$, **in f**: $\mathbb{Z}$, **in c**: $\mathbb{Z}$, **out result**: Bool) {

Pre {$tableroValido(t) \wedge$ enRango(t,f) $\wedge_L$ enRango(t[f],c) $\wedge_L$ celdaVacia(t[f][c]) =false }
Post {**result** $= t[f][c]$}
}

7. proc sudoku_llenarCelda (**inout t**: $seq\langle seq\langle \mathbb{Z}\rangle\rangle$ **in f**: $\mathbb{Z}$, **in c**: $\mathbb{Z}$, **in value**: $\mathbb{Z}$) {

Pre {$tableroValido(t) \wedge$
$0 \leq f, c \leq 8 \wedge$
$1 \leq value \leq 9 \wedge$
t $=$ t$_0 \wedge$

$t_0[f][c] = 0\}$
Post $\{t = SetAt(t_0, c, value)\}$
}

8. proc sudoku_vaciarCelda (**inout t:** $seq\langle seq\langle \mathbb{Z}\rangle\rangle$, **in f**: $\mathbb{Z}$, **in c**: $\mathbb{Z}$, **out result:** Bool) {
Pre $\{tableroValido(t)\}$
Post $\{\}$
}

9. proc sudoku_esTableroParcialmenteResuelto (**in t**: $seq\langle seq\langle \mathbb{Z}\rangle\rangle$, **out result**: Bool) {
Pre $\{\text{True}\}$
Post $\{\textbf{result} = TableroParcialmenteResuelto(t)\}$
}

10. proc sudoku_esTableroTotalmenteResuelto (**in t**: $seq\langle seq\langle \mathbb{Z}\rangle\rangle$, **out result**: Bool) {
Pre $\{tableroValido(t)\}$
Post $\{\}$
}

11. proc sudoku_esSubTablero (**in** $t_0, t_1 : seq\langle seq\langle \mathbb{Z}\rangle\rangle$, **out result** : Bool){
Pre $\{tableroValido(t_0), tableroValido(t_1)\}$
Post $\{result = (\forall i : \mathbb{Z})(\forall j : \mathbb{Z})\}$
}

12. proc sudoku_tieneSolucion (**in t**: $seq\langle seq\langle \mathbb{Z}\rangle\rangle$, **out tienesolucion**: Bool) {
Pre $\{tableroValido(t)\}$
Post $\{\}$
}

13. proc sudoku_resolver (**inout t**: $seq\langle seq\langle \mathbb{Z}\rangle\rangle$, **out tienesolucion**: Bool) {
Pre $\{\text{True}\}$
Post $\{fun\ \ Resolver\ (t : seq\langle seq\langle \mathbb{Z}\rangle\rangle)\ : seq\langle seq\langle \mathbb{Z}\rangle\rangle =$
if $esSub(t, x) \wedge_L$ tableroParcialmenteResuleto(x) then x else t fi **;**
}
}

14. proc sudoku_copiarTablero (**in src**: $seq\langle seq\langle \mathbb{Z}\rangle\rangle$, **out target**: $seq\langle seq\langle \mathbb{Z}\rangle\rangle$) {
Pre $\{\text{True}\}$
Post $\{src = target\}$
}

2. Predicados y Auxiliares generales

pred Nombre (t: $seq\langle seq\langle \mathbb{Z}\rangle\rangle$) {True}
pred PredLargo (t: $seq\langle seq\langle \mathbb{Z}\rangle\rangle$) {
$(\forall i : \mathbb{Z})(\forall j : \mathbb{Z})$True
}
fun Aux (i: $\mathbb{Z}$) : Bool = True **;**
pred enRango (t: $seq\langle t\rangle$, i:$\mathbb{Z}$) {
$0 \leq i < length(t)$
}

3. Decisiones tomadas