GRUPO:............

Tecnología de la Programación. ITIS. Curso 2007/2008

Grupos Cooperativos. Seminario 2. 19 de Noviembre de 2007

1. Calcula y simplifica: $wp("b[i], b[0] := b[b[i]], b[i]; b[b[i]] := b[0]", b[0] = b[i])$.

$wp("b[i], b[0] := b[b[i]], b[i]; b[b[i]] := b[0]", b[0] = b[i])$

$\equiv wp("b[i], b[0] := b[b[i]], b[i]", \underbrace{wp("b[b[i]] := b[0]", b[0] = b[i])})$

Calculamos primero el wp para la última instrucción:

$wp("b[b[i]] := b[0]", b[0] = b[i])) \equiv enrango(b, 0)$ cand $dominio(b[0])$ cand $enrango(b, i)$ cand $dominio(b[i])$ cand $enrango(b, b[i])$ cand $(b[0] = b[i])^b_{(b;b[i]:b[0])}$

Desarrollando el último término obtenemos:

$\equiv (b; b[i] : b[0])[0] = (b; b[i] : b[0])[i]$

$\equiv (b[i] = 0 \wedge b[0] = (b; b[i] : b[0])[i]) \vee (b[i] \neq 0 \wedge (b[0] = (b; b[i] : b[0])[i])$

Sacando factor común:

$\equiv (b[i] = 0 \vee b[i] \neq 0) \wedge b[0] = (b; b[i] : b[0])[i])$

$\equiv T \wedge (b[0] = (b; b[i] : b[0])[i])$

$\equiv b[0] = (b; b[i] : b[0])[i]$

$\equiv (b[i] = i \wedge b[0] = b[0]) \vee (b[i] \neq i \wedge b[0] = b[i])$

$\equiv b[i] = i \vee (b[i] \neq i \wedge b[0] = b[i])$

$\equiv (b[i] = i \vee b[0] = b[i])$

Sustituyendo ahora en la expresión inicial:

$wp("b[i], b[0] := b[b[i]], b[i]", enrango(b, 0)$ cand $dominio(b[0])$ cand $enrango(b, i)$ cand $dominio(b[i])$ cand $enrango(b, b[i])$ cand $b[i] = i \vee b[0] = b[i])$

$\equiv enrango(b, i)$ cand $dominio(b[i])$ cand $enrango(b, b[i])$ cand $dominio(b[b[i]])$ cand $enrango(b, 0)$
cand $enrango((b; i : b[b[i]]; 0 : b[i]), 0)$ cand $dominio((b; i : b[b[i]]; 0 : b[i])[0])$
cand $enrango((b; i : b[b[i]]; 0 : b[i]), i)$ cand $dominio((b; i : b[b[i]]; 0 : b[i])[i])$
cand $enrango((b; i : b[b[i]]; 0 : b[i]), (b; i : b[b[i]]; 0 : b[i])[i])$ cand $(b[i] = i \vee b[0] = b[i])^b_{(b;i:b[b[i]];0:b[i])}$

$\equiv enrango(b, i)$ cand $dominio(b[i])$ cand $enrango(b, b[i])$ cand $dominio(b[b[i]])$ cand $enrango(b, 0)$
cand $enrango(b, i)$ cand $enrango(b, 0)$ cand $dominio(b[b[i]])$ cand $dominio(b[0])$
cand $enrango(b, i)$ cand $enrango(b, 0)$ cand $dominio(b[b[i]])$cand $dominio(b[i])$
cand $enrango(b, i)$ cand $enrango(b, 0)$ cand $enrango(b, b[i])$ cand $enrango(b, b[i])$
cand $(b[i] = i \vee b[0] = b[i])^b_{(b;i:b[b[i]];0:b[i])}$

$\equiv enrango(b,i)$ cand $dominio(b[i])$ cand $enrango(b,b[i])$ cand $dominio(b[b[i]])$ cand $enrango(b,0)$ cand $dominio(b[0])$ cand $enrango(b,b[b[i]])$ cand $(b[i]=i \vee b[0]=b[i])^b_{(b;i:b[b[i]];0:b[i])}$

Resolviendo el último término:

$(b[i]=i \vee b[0]=b[i])^b_{(b;i:b[b[i]];0:b[i])}$

$\equiv (b;i:b[b[i]];0:b[i])[i]=i \vee (b;i:b[b[i]];0:b[i])[0]=(b;i:b[b[i]];0:b[i])[i]$

$\equiv (0=i \wedge (b[i]=i \vee b[i]=b[i])) \vee (0 \neq i \wedge ((b;i:b[b[i]])[i]=i \vee b[i]=(b;i:b[b[i]])[i]))$

$\equiv (0=i \wedge (b[i]=i \vee T)) \vee (0 \neq i \wedge (b[b[i]]=i \vee b[i]=b[b[i]]))$

$\equiv 0=i \vee (0 \neq i \wedge (b[b[i]]=i \vee b[i]=b[b[i]]))$

$\equiv 0=i \vee b[b[i]]=i \vee b[i]=b[b[i]]$

Con lo que la solución final quedaría:

$\equiv enrango(b,i)$ cand $dominio(b[i])$ cand $enrango(b,b[i])$ cand $dominio(b[b[i]])$ cand $enrango(b,0)$ cand $dominio(b[0])$ cand $enrango(b,b[b[i]])$ cand cand $(0=i \vee b[b[i]]=i \vee b[i]=b[b[i]])$

2. Calcula y simplifica: $wp(\text{"}b[k],b[b[k]]:=b[b[k]],b[k]\text{"}, b[k] \neq b[b[k]])$.

$wp(\text{"}b[k],b[b[k]]:=b[b[k]],b[k]\text{"}, b[k] \neq b[b[k]])$

$\equiv enrango(b,k)$ cand $dominio(b[k])$ cand $enrango(b,b[k])$ cand $dominio(b[b[k]])$ cand $(b[k] \neq b[b[k]])^b_{(b;k:b[b[k]];b[k]:b[k])}$

Desarrollando el último término obtenemos:

$\equiv (b;k:b[b[k]];b[k]:b[k])[k] \neq (b;k:b[b[k]];b[k]:b[k])[(b;k:b[b[k]];b[k]:b[k])[k]]$

$\equiv (b[k]=k \wedge b[k] \neq (b;k:b[b[k]];b[k]:b[k])[b[k]])$
$\vee(b[k] \neq k \wedge (b;k:b[b[k]])[k] \neq (b;k:b[b[k]];b[k]:b[k])[(b;k:b[b[k]])[k]])$

$\equiv (b[k]=k \wedge \underbrace{b[k] \neq b[k]}_{F}) \vee (b[k] \neq k \wedge (b;k:b[b[k]])[k] \neq (b;k:b[b[k]];b[k]:b[k])[(b;k:b[b[k]])[k]])$

$\equiv (b[k] \neq k \wedge b[b[k]] \neq (b;k:b[b[k]];b[k]:b[k])[b[b[k]]])$

$\equiv (\underbrace{b[k]=b[b[k]]} \wedge b[k] \neq k \wedge \underbrace{b[b[k]] \neq b[k]}) \vee (b[k] \neq b[b[k]] \wedge b[k] \neq k \wedge b[b[k]] \neq (b;k:b[b[k]])[b[b[k]]])$

$\equiv (F \wedge b[k] \neq k) \vee (b[k] \neq b[b[k]] \wedge b[k] \neq k \wedge b[b[k]] \neq (b;k:b[b[k]])[b[b[k]]])$

$\equiv (b[k] \neq b[b[k]] \wedge b[k] \neq k \wedge b[b[k]] \neq (b;k:b[b[k]])[b[b[k]]])$

$\equiv (k=b[b[k]] \wedge b[k] \neq b[b[k]] \wedge b[k] \neq k \wedge \underbrace{b[b[k]] \neq b[b[k]]}_{F}) \vee (k \neq b[b[k]] \wedge b[k] \neq b[b[k]] \wedge b[k] \neq k$

$\wedge b[b[k]] \neq b[b[b[k]]])$

$\equiv (k \neq b[b[k]] \wedge b[k] \neq b[b[k]] \wedge b[k] \neq k \wedge b[b[k]] \neq b[b[b[k]]])$

Con lo que la solución final quedaría:

$\equiv enrango(b,k)$ cand $dominio(b[k])$ cand $enrango(b,b[k])$ cand $dominio(b[b[k]])$ cand $(k \neq b[b[k]] \wedge b[k] \neq b[b[k]] \wedge b[k] \neq k \wedge b[b[k]] \neq b[b[b[k]]])$

3. Calcula y simplifica: $wp(\text{"}b[j], b[b[k]] := b[j], b[k]; b[j], b[k] := k, b[j]\text{"}, b[k] = b[b[k]])$.

$wp(\text{"}b[j], b[b[k]] := b[j], b[k]; b[j], b[k] := k, b[j]\text{"}, b[k] = b[b[k]])$

$\equiv wp(\text{"}b[j], b[b[k]] := b[j], b[k]\text{"}, \underbrace{wp(\text{"}b[j], b[k] := k, b[j]\text{"}, b[k] = b[b[k]])})$

Calculamos primero el wp para la última instrucción:

$wp(\text{"}b[j], b[k] := k, b[j]\text{"}, b[k] = b[b[k]]) \equiv enrango(b, j)$ cand $dominio(b[j])$ cand $enrango(b, k)$ cand $(b[k] = b[b[k]])^b_{(b;j:k;k:b[j])}$

Desarrollando el último término obtenemos:

$\equiv (b; j : k; k : b[j])[k] = (b; j : k; k : b[j])[(b; j : k; k : b[j])[k]] \equiv b[j] = (b; j : k; k : b[j])[b[j]]$

$\equiv (k = b[j] \wedge b[j] = b[j]) \vee (k \neq b[j] \wedge b[j] = (b; j : k)[b[j]])$

$\equiv k = b[j] \vee (k \neq b[j] \wedge b[j] = (b; j : k)[b[j]])$

$\equiv k = b[j] \vee b[j] = (b; j : k)[b[j]]$

$\equiv k = b[j] \vee (j = b[j] \wedge b[j] = k) \vee (j \neq b[j] \wedge b[j] = b[b[j]])$ (simplificamos $\alpha \vee (\beta \wedge \alpha) \equiv \alpha$)

$\equiv k = b[j] \vee (j \neq b[j] \wedge b[j] = b[b[j]])$

Sustituyendo ahora en la expresión inicial:

$wp(\text{"}b[j], b[b[k]] := b[j], b[k]\text{"}, enrango(b, j)$ cand $dominio(b[j])$ cand $enrango(b, k)$ cand $(k = b[j] \vee (j \neq b[j] \wedge b[j] = b[b[j]])))$

$\equiv enrango(b, j)$ cand $dominio(b[j])$ cand $enrango(b, k)$ cand $dominio(b[k])$ cand $enrango(b, b[k])$ cand $enrango(b, j)$ cand $enrango(b, b[k])$ cand $dominio(b[j])$ cand $dominio(b[k])$ cand $enrango(b, j)$ cand $enrango(b, k)$ cand $enrango(b, b[k])$ cand $(k = b[j] \vee (j \neq b[j] \wedge b[j] = b[b[j]]))^b_{(b;j:b[j];b[k]:b[k])}$

$\equiv enrango(b, j)$ cand $dominio(b[j])$ cand $enrango(b, k)$ cand $dominio(b[k])$ cand $enrango(b, b[k])$ cand $(k = b[j] \vee (j \neq b[j] \wedge b[j] = b[b[j]]))^b_{(b;j:b[j];b[k]:b[k])}$

Resolviendo el último término:

$(k = b[j] \vee (j \neq b[j] \wedge b[j] = b[b[j]]))^b_{(b;j:b[j];b[k]:b[k])}$

$k = (b; j : b[j]; b[k] : b[k])[j]$
$\vee(j \neq (b; j : b[j]; b[k] : b[k])[j] \wedge (b; j : b[j]; b[k] : b[k])[j] = (b; j : b[j]; b[k] : b[k])[(b; j : b[j]; b[k] : b[k])[j]])$

$(b[k] = j \wedge (k = b[k] \vee (j \neq b[k] \wedge b[k] = (b; j : b[j]; b[k] : b[k])[b[k]])))$
$\vee(b[k] \neq j \wedge (k = (b; j : b[j])[j] \vee (j \neq (b; j : b[j])[j] \wedge (b; j : b[j])[j] = (b; j : b[j]; b[k] : b[k])[(b; j : b[j])[j]])))$

$(b[k] = j \wedge (k = b[k] \vee (j \neq b[k] \wedge b[k] = b[k])))$
$\vee(b[k] \neq j \wedge (k = b[j] \vee (j \neq b[j] \wedge b[j] = (b; j : b[j]; b[k] : b[k])[b[j]])))$

$(b[k] = j \wedge (k = b[k] \vee j \neq b[k]))$
$\vee(b[k] \neq j \wedge (k = b[j] \vee (j \neq b[j] \wedge b[j] = (b; j : b[j]; b[k] : b[k])[b[j]])))$

$(b[k] = j \wedge k = b[k])$
$\vee (b[k] \neq j \wedge k = b[j]) \vee \underbrace{(b[k] \neq j \wedge j \neq b[j] \wedge b[j] = (b; j : b[j]; b[k] : b[k])[b[j]])}_{\alpha}$

Resolvemos el término α:

$\alpha \equiv (b[k] \neq j \wedge j \neq b[j] \wedge b[j] = (b; j : b[j]; b[k] : b[k])[b[j]])$

$(b[k] = b[j] \wedge b[k] \neq j \wedge j \neq b[j] \wedge b[j] = b[k])$
$\vee (b[k] \neq b[j] \wedge b[k] \neq j \wedge j \neq b[j] \wedge b[j] = (b; j : b[j])[b[j]])$

$(b[k] = b[j] \wedge b[k] \neq j \wedge j \neq b[j])$
$\vee (b[k] \neq b[j] \wedge b[k] \neq j \wedge j \neq b[j] \wedge b[j] = b[b[j]])$

Simplificando mediante $(a \wedge b) \vee (\neg a \wedge b \wedge c) \equiv (b \wedge a) \vee (b \wedge c)$, tenemos:

$(b[k] = b[j] \wedge b[k] \neq j \wedge j \neq b[j])$
$\vee (b[k] \neq j \wedge j \neq b[j] \wedge b[j] = b[b[j]])$

Sustituimos α en la expresión de partida:

$(b[k] = j \wedge k = b[k]) \vee (b[k] \neq j \wedge k = b[j]) \vee (b[k] = b[j] \wedge b[k] \neq j \wedge j \neq b[j])$
$\vee (b[k] \neq j \wedge j \neq b[j] \wedge b[j] = b[b[j]])$

$(b[k] = j \wedge k = b[k]) \vee (b[k] \neq j \wedge k = b[j]) \vee (b[k] = b[j] \wedge b[k] \neq j)$
$\vee (b[k] \neq j \wedge j \neq b[j] \wedge b[j] = b[b[j]])$

Con lo que la solución final quedaría:

$\equiv enrango(b, j)$ cand $dominio(b[j])$ cand $enrango(b, k)$ cand $dominio(b[k])$ cand $enrango(b, b[k])$
cand $(b[k] = j \wedge k = b[k]) \vee (b[k] \neq j \wedge k = b[j]) \vee (b[k] = b[j] \wedge b[k] \neq j) \vee (b[k] \neq j \wedge j \neq b[j] \wedge b[j] = b[b[j]])$