

$$\begin{aligned}
& \text{sem_P}(\text{begin } R := 1; I := 1; \text{while } 2*N + 2 > I \text{ do begin } R := R*I; I := I + 2 \text{ end end}) = \\
& = \text{sem_S}(R := 1; I := 1; \text{while } 2*N + 2 > I \text{ do begin } R := R*I; I := I + 2 \text{ end}) = \\
& = \text{sem_S}(R := 1) \bullet \text{sem_S}(I := 1; \text{while } 2*N + 2 > I \text{ do begin } R := R*I; I := I + 2 \text{ end}) = \\
& = \text{sem_S}(R := 1) \bullet \text{sem_S}(I := 1) \bullet \text{sem_S}(\text{while } 2*N + 2 > I \text{ do begin } R := R*I; I := I + 2 \text{ end}) = \\
& = \text{AS}^R(\text{sem_A}(1)) \bullet \text{AS}'(\text{sem_A}(1)) \bullet \text{sem_S}(\text{while } 2*N + 2 > I \text{ do begin } R := R*I; I := I + 2 \text{ end}) = \\
& = \text{AS}^R(\bar{1}) \bullet \text{AS}'(\bar{1}) \bullet \text{sem_S}(\text{while } 2*N + 2 > I \text{ do begin } R := R*I; I := I + 2 \text{ end}) = \\
& = \text{AS}^R(\bar{1}) \bullet \text{AS}'(\bar{1}) \bullet \text{WH}(\text{sem_B}(2*N + 2 > I), \text{sem_S}(\text{begin } R := R*I; I := I + 2 \text{ end})) = \\
& = \text{AS}^R(\bar{1}) \bullet \text{AS}'(\bar{1}) \bullet \text{WH}(\text{sem_B}(2*N + 2 > I), \text{sem_S}(R := R*I; I := I + 2)) = \\
& = \text{AS}^R(\bar{1}) \bullet \text{AS}'(\bar{1}) \bullet \text{WH}(S^2(\text{gr}, \text{sem_A}(2*N + 2), \text{sem_A}(I)), \text{sem_S}(R := R*I; I := I + 2)) = \\
& = \text{AS}^R(\bar{1}) \bullet \text{AS}'(\bar{1}) \bullet \text{WH}(S^2(\text{gr}, \text{sem_A}(2*N + 2), \text{sem_A}(I)), \text{sem_S}(R := R*I) \bullet \text{sem_S}(I := I + 2)) = \\
& = \text{AS}^R(\bar{1}) \bullet \text{AS}'(\bar{1}) \bullet \text{WH}(S^2(\text{gr}, \text{sem_A}(2*N + 2), I \Rightarrow), \text{sem_S}(R := R*I) \bullet \text{sem_S}(I := I + 2)) = \\
& = \text{AS}^R(\bar{1}) \bullet \text{AS}'(\bar{1}) \bullet \text{WH}(S^2(\text{gr}, \text{sem_A}(2*N + 2), I \Rightarrow), \text{AS}^R(\text{sem_A}(R*I)) \bullet \text{AS}'(\text{sem_A}(I + 2))) = \\
& = \text{AS}^R(\bar{1}) \bullet \text{AS}'(\bar{1}) \bullet \text{WH}(S^2(\text{gr}, S^2(\text{add}, \text{sem_A}(2*N), \text{sem_A}(2)), I \Rightarrow), \text{AS}^R(\text{sem_A}(R*I)) \bullet \text{AS}'(S^2(\text{add}, \\
& \text{sem_A}(I), \text{sem_A}(2)))) = \\
& = \text{AS}^R(\bar{1}) \bullet \text{AS}'(\bar{1}) \bullet \text{WH}(S^2(\text{gr}, S^2(\text{add}, S^2(\text{mult}, \text{sem_A}(2), \text{sem_A}(N)), \text{sem_A}(2)), I \Rightarrow), \text{AS}^R(S^2(\text{mult}, \\
& \text{sem_A}(R), \text{sem_A}(I))) \bullet \text{AS}'(S^2(\text{add}, \text{sem_A}(I), \text{sem_A}(2)))) = \\
& = \text{AS}^R(\bar{1}) \bullet \text{AS}'(\bar{1}) \bullet \text{WH}(S^2(\text{gr}, S^2(\text{add}, S^2(\text{mult}, \text{sem_A}(2), N \Rightarrow), \text{sem_A}(2)), I \Rightarrow), \text{AS}^R(S^2(\text{mult}, R \Rightarrow, I \Rightarrow)) \bullet \\
& \text{AS}'(S^2(\text{add}, I \Rightarrow, \text{sem_A}(2)))) = \\
& = \text{AS}^R(\bar{1}) \bullet \text{AS}'(\bar{1}) \bullet \text{WH}(S^2(\text{gr}, S^2(\text{add}, S^2(\text{mult}, \bar{2}, N \Rightarrow), \bar{2}), I \Rightarrow), \text{AS}^R(S^2(\text{mult}, R \Rightarrow, I \Rightarrow)) \bullet \text{AS}'(S^2(\text{add}, I \Rightarrow, \bar{2})))
\end{aligned}$$

$$\frac{f_b}{f_s} \cdot \frac{AS^R(\bar{1}) \cdot AS^I(\bar{1}) \cdot WH(S^2(gr, S^2(add, S^2(mult, \bar{2}, N \Rightarrow), \bar{2}), I \Rightarrow), AS^R(S^2(mult, R \Rightarrow, I \Rightarrow)) \cdot AS^I(S^2(add, I \Rightarrow, \bar{2})))}{[N \mapsto 2]} =$$

$$= AS^I(\bar{1})(AS^R(\bar{1})([N \mapsto 2])) \cdot WH(f_b, f_s) =$$

$$= WH(f_b, f_s)(AS^I(\bar{1})(AS^R(\bar{1})([N \mapsto 2]))) \quad \textcircled{=}$$

$$st = [N \mapsto 2]$$

$$st' = AS^R(\bar{1})(st) = st \nabla [R \mapsto \bar{1}(st)] = st \nabla [R \mapsto 1] =$$

$$= [N \mapsto 2, R \mapsto 1]$$

$$\textcircled{=} WH(f_b, f_s)(AS^I(\bar{1})(st')) \quad \textcircled{=}$$

$$AS^I(\bar{1})(st_1) = st_1 \nabla [I \mapsto \bar{1}(st_1)] = st_1 \nabla [I \mapsto 1] =$$

$$= [N \mapsto 2, R \mapsto 1, I \mapsto 1]$$

$$\textcircled{=} WH(f_b, f_s)([N \mapsto 2, R \mapsto 1, I \mapsto 1]) \quad \textcircled{=}$$

$$o) st_0 = ([N \mapsto 2, R \mapsto 1, I \mapsto 1])$$

$$f_b(st_0) = S^2(gr, S^2(add, S^2(mult, \bar{2}, N \Rightarrow), \bar{2}), I \Rightarrow)(st_0) =$$

$$= gr(S^2(add, S^2(mult, \bar{2}, N \Rightarrow), \bar{2}))(st_0, I \Rightarrow(st_0)) =$$

$$= gr(add(S^2(mult, \bar{2}, N \Rightarrow)(st_0), \bar{2}(st_0)), I \Rightarrow(st_0)) =$$

$$= gr(add(mult(\bar{2}(st_0), N \Rightarrow(st_0)), \bar{2}(st_0)), I \Rightarrow(st_0)) =$$

$$= gr(add(mult(2, 2), 2), 1) = gr(add(4, 2), 1) =$$

$$= gr(6, 1) = true$$

$$f_s(st_0) = AS^R(S^2(mult, R \Rightarrow, I \Rightarrow)) \cdot AS^I(S^2(add, I \Rightarrow, \bar{2}))(st_0) = AS^I(S^2(add, I \Rightarrow, \bar{2}))(AS^R(S^2(mult, R \Rightarrow, I \Rightarrow))(st_0))$$

$$st'_0 = AS^R(S^2(mult, R \Rightarrow, I \Rightarrow))(st_0) = st_0 \nabla [R \mapsto$$

$$I \mapsto S^2(mult, R \Rightarrow, I \Rightarrow)(st_0) = st_0 \nabla [R \mapsto mult(R \Rightarrow(st_0), I \Rightarrow(st_0))] = st_0 \nabla [R \mapsto mult(1, 1)] = st_0 \nabla [R \mapsto 1]$$

$$st'_0 = [N \mapsto 2, R \mapsto 1, I \mapsto 1]$$

$$\begin{aligned} f_s(st_0) &= ASI(s^2(add, I \Rightarrow, 2))(st'_0) = \\ &= st'_0 \nabla [I \mapsto s^2(add, I \Rightarrow, 2)] = \\ &= st'_0 \nabla [I \mapsto add(I \Rightarrow(st'_0), 2(st'_0))] = \\ &= st'_0 \nabla [I \mapsto add(1, 2)] = st'_0 \nabla [I \mapsto 3] = \\ &= [N \mapsto 2, R \mapsto 1, I \mapsto 3] \end{aligned}$$

$$st_1 = f_s(st_0) = [N \mapsto 2, R \mapsto 1, I \mapsto 3]$$

Анализировано начальных вырезов:

$$\begin{aligned} 1) f_b(st_1) &= gr(add(mult(2, 2), 2), 3) = \\ &= gr(6, 3) = true \end{aligned}$$

$$\begin{aligned} st'_1 &= st_1 \nabla [R \mapsto mult(1, 3)] = \\ &= st_1 \nabla [R \mapsto 3] = [N \mapsto 2, R \mapsto 3, I \mapsto 3] \end{aligned}$$

$$\begin{aligned} f_s(st_1) &= st'_1 \nabla [I \mapsto add(3, 2)] = \\ &= st'_1 \nabla [I \mapsto 5] = [N \mapsto 2, R \mapsto 3, I \mapsto 5] \end{aligned}$$

$$st_2 = f_s(st_1) = [N \mapsto 2, R \mapsto 3, I \mapsto 5]$$

$$2) f_b(st_2) = gr(6, 5) = true$$

$$\begin{aligned} st'_2 &= st_2 \nabla [R \mapsto mult(3, 5)] = \\ &= st_2 \nabla [R \mapsto 15] = [N \mapsto 2, R \mapsto 15, I \mapsto 5] \end{aligned}$$

$$\begin{aligned} f_s(st_2) &= st'_2 \nabla [I \mapsto add(5, 2)] = \\ &= st'_2 \nabla [I \mapsto 7] = [N \mapsto 2, R \mapsto 15, I \mapsto 7] \end{aligned}$$

$$st_3 = f_s(st_2) = [N \mapsto 2, R \mapsto 15, I \mapsto 7]$$

$$3) f_b(st_3) = gr(6, 7) = false$$

$$\textcircled{=} st_3 = [N \mapsto 2, R \mapsto 15, I \mapsto 7]$$