

$WP(\mathbf{a} := \mathbf{a}+1; \mathbf{b} := \mathbf{a}/2, b \geq 0)$ (ejercicio 2.a de la práctica)

$$WP(\mathbf{a} := \mathbf{a}+1; \mathbf{b} := \mathbf{a}/2, b \geq 0) \equiv WP(\mathbf{a} := \mathbf{a}+1, WP(\mathbf{b} := \mathbf{a}/2, b \geq 0)) \text{ --- Axioma 3}$$

$$WP(\mathbf{b} := \mathbf{a}/2, b \geq 0) \equiv def(a/2) \wedge_L (b \geq 0)_{a/2}^b \text{ --- Axioma 1}$$

$$def(a/2) \wedge_L Q_{a/2}^b \equiv \{True \wedge_L a/2 \geq 0\} \equiv \{a \geq 0\} \text{ --- Definiciones}$$

$$WP(\mathbf{a} := \mathbf{a}+1, a \geq 0) \equiv def(a+1) \wedge_L (a \geq 0)_{a+1}^a \text{ --- Axioma 1}$$

$$def(a+1) \wedge_L (a \geq 0)_{a+1}^a \equiv \{True \wedge_L a+1 \geq 0\} \equiv \boxed{a \geq -1} \text{ --- Definiciones}$$

$$WP(\mathbf{A}[\mathbf{i}] := \mathbf{A}[\mathbf{i}-1], (\forall j : \mathbb{Z})(0 \leq j < |A| \rightarrow_L A[j] \geq 0))$$

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$$WP(\mathbf{A} := \mathbf{setAt}(\mathbf{A}, \mathbf{i}, \mathbf{A}[\mathbf{i}-1]), (\forall j : \mathbb{Z})(0 \leq j < |A| \rightarrow_L A[j] \geq 0)) \equiv \text{--- Reemplazo por setAt()}$$

$$def(setAt(A, i, A[i-1])) \wedge_L Q_{setAt(A, i, A[i-1])}^A \text{ --- Axioma 1}$$

$$def(setAt(A, i, A[i-1])) \equiv (def(A) \wedge def(i) \wedge def(A[i-1])) \wedge_L 0 \leq i < |A| \equiv$$

$$(True \wedge True \wedge 0 \leq i-1 < |A|) \wedge_L 0 \leq i < |A| \equiv 1 \leq i < |A| + 1 \wedge_L 0 \leq i < |A| \equiv 1 \leq i < |A|$$

$$Q_{setAt(A, i, A[i-1])}^A \equiv (\forall j : \mathbb{Z})(0 \leq j < |A|) \rightarrow_L setAt(A, i, A[i-1])[j] \geq 0) \equiv$$

$$(\forall j : \mathbb{Z})(0 \leq j < |A|) \rightarrow_L (i = j \wedge A[i-1] \geq 0) \vee (i \neq j \wedge A[j] \geq 0)$$

Como $i \neq j \wedge A[j] \geq 0$ implica $i = j \wedge A[i-1] \geq 0$ podemos simplificar a

$$(\forall j : \mathbb{Z})(0 \leq j < |A|) \rightarrow_L i \neq j \wedge A[j] \geq 0$$

Juntando todo tenemos

$$WP(\mathbf{A}[\mathbf{i}] := \mathbf{A}[\mathbf{i}-1], (\forall j : \mathbb{Z})(0 \leq j < |A| \rightarrow_L A[j] \geq 0)) \equiv$$

$$\boxed{1 \leq i < |A| \wedge_L (\forall j : \mathbb{Z})(0 \leq j < |A|) \rightarrow_L i \neq j \wedge A[j] \geq 0}$$

Ejercicio 4.a

$$S \equiv \mathbf{if}(a < 0) \mathbf{b} := \mathbf{a} \mathbf{else} \mathbf{b} := -\mathbf{a} \mathbf{endif}$$

$$Q \equiv (b = -|a|)$$

$$WP(S, b = -|a|) \equiv \text{--- Axioma 4}$$

$$def(a < 0) \wedge_L ((a < 0 \wedge WP(\mathbf{b} := \mathbf{a}, b = -|a|)) \vee (a \geq 0 \wedge WP(\mathbf{b} := -\mathbf{a}, b = -|a|))) \equiv$$

$$True \wedge_L ((a < 0 \wedge a = -|a|) \vee (a \geq 0 \wedge a = -|a|)) \equiv \text{--- Axioma 1}$$

$$((a < 0 \wedge a = a) \vee (a \geq 0 \wedge a = -a)) \equiv \boxed{True} \text{ --- Siguiendo la lógica}$$