Assignment 1: Background theory

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- 1. (a) $y:[\text{true}, (x=0 \land y=0) \lor (x \neq 0 \land y=\frac{y_0}{x})]$
 - (b) $y : [\text{true}, (x = 0) \lor (x \neq 0 \land y = \frac{y_0}{x})]$
 - (c) TODO
- 2. $x, y : [\text{true}, x = z^2 \land y = z^4]$
 - \sqsubseteq {Composition}

$$x, y : [\text{true}, x = z^2]; \ x, y : [x = z^2, x = z^2 \land y = z^4]$$

- \sqsubseteq {Assignment: true $\Rightarrow x = z^2[x \setminus z^2]$ }
 - $x = z^2$; $x, y : [x = z^2, x = z^2 \land y = z^4]$
- 3. (a) Assuming

$$wp(y := 10, \text{ true}) \equiv \text{true}[y \setminus 10]$$

 $\equiv \text{true}$

we can conclude that

$$wp(\mathbf{if}\ (x>0\ \lor\ y<10)\to y:=10\ \mathbf{fi},\ \mathrm{true})\ \equiv\ (x>0\ \lor\ y<10)\ \land\\ ((x>0\ \lor\ y<10)\to wp(y:=10,\ \mathrm{true}))$$

$$\equiv\ (x>0\ \lor\ y<10)\ \land\ \mathrm{true}$$

$$\equiv\ (x>0\ \lor\ y<10)$$

As $y < 10 \Rightarrow (x > 0 \lor y < 10)$, the Hoare triple is true.

(b) Assuming

$$wp(x := x + y, P[x \backslash x + y]) \equiv (P[x \backslash x + y])[x \backslash x + y]$$

TODO

- 4. (a) y: [y < 10, y > 0]
 - \sqsubseteq {Selection: $y < 10 \Rightarrow (x > 0 \lor y < 10)$ }

if
$$(x > 0 \lor y < 10) \to y : [(x > 0 \lor y < 10) \land (y < 10), y > 0]$$
 fi

- \sqsubseteq {Absorption 1: $(x > 0 \lor y < 10) \land (y < 10) = y < 10$ }
 - **if** $(x > 0 \lor y < 10) \to y : [y < 10, y > 0]$ **fi**
- $\sqsubseteq \{ \text{Assignment: } y < 10 \Rightarrow y > 0[y \setminus 10] \}$
- **if** $(x > 0 \lor y < 10) \to y := 10$ **fi**
- (b) y: [y < 10, y > 0]
 - $\not\sqsubseteq \{ \text{Selection: } y < 10 \not \Rightarrow ((x > 0) \land (y < 10)) \}$
 - if $((x > 0) \land (y < 10)) \rightarrow y : [((x > 0) \land (y < 10)) \land (y < 10), y > 0]$ fi

5. TODO