

# Hints for A moment's thought

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## Chapter 2

**A moment's thought 2.2** Try reading out the formula in English, replacing the quantifiers by 'for all' and 'there exists'. Remember that  $y + y = 2y$ .

**A moment's thought 2.5** What do we call an integer  $n$  with no divisors except  $n$  and 1?

**A moment's thought 2.2** Try reading out the formula in English, replacing the quantifiers by 'for all' and 'there exists'. Remember that  $x + x = 2x$ .

**A moment's thought 2.8** Try some examples. A good start is to consider  $\mathbf{A} = \{1, 2, 3\}$  and  $\mathbf{B} = \{4, 5\}$ . Next, consider  $\mathbf{A} = \{1, 2, 3\}$  and  $\mathbf{B} = \{1, 2, 5\}$ .

**A moment's thought 2.10** Try some examples. A good start is to consider  $\mathbf{A} = \{1, 2, 3\}$  and  $\mathbf{B} = \{1, 5\}$ . Next, consider  $\mathbf{A} = \{1, 2, 3\}$  and  $\mathbf{B} = \{1, 2, 3, 5\}$ .

**A moment's thought 2.14** Try some examples. A good start is to consider  $\mathbf{A} = \{1, 2, 3\}$  and  $\mathbf{B} = \{1, 5\}$ . Next, consider  $\mathbf{A} = \{1, 2, 3\}$  and  $\mathbf{B} = \{1, 2, 3, 5\}$ .

**A moment's thought 2.17** Check that the conditions in Definition 2.16 apply.

**A moment's thought 2.18** Johnny Cash and June Carter both had children from their first marriages. After they married, they had a son. Which of the conditions of Definition 2.16 fails to hold in this case?

**A moment's thought 2.19** What must an assignment satisfy in order to be a function?

**A moment's thought 2.23** There are many well-known examples from calculus and trigonometry.

**A moment's thought 2.24** Which requirement is stronger: To be total or to be partial?

**A moment's thought 2.27** First, find an example of a function from **A** to **B**. Then find the others.

**A moment's thought 2.28** How many functions did you find in **A moment's thought 2.27**?

**A moment's thought 2.29** First, find an example of a partial function from **A** to **B** that fails to be total. Then find all other partial.

### Chapter 3

**A moment's thought 3.1** How does the text define and exemplify the notion of immediate constituents?

**A moment's thought 3.6** Try using the rule to find a transition  $3 + 4 \rightarrow v$ .

**A moment's thought 3.9** Can we have transitions that are not derived from a transition rule?

### Chapter 4

**A moment's thought 4.2** How many variables are there in a program? Finitely or infinitely many? How many variables are there in **Var**?

**A moment's thought 4.15** What do  $k$ ,  $k_1$  and  $k_2$  stand for?

**A moment's thought 4.17** How long is a transition sequence in a big-step semantics?

### Chapter 5

**A moment's thought 5.3** Where and how was  $\rightarrow_b$  defined?

**A moment's thought 5.13** Have a look at the definitions of  $\sim_{sss}$  and  $\sim_{bss}$ .

**A moment's thought 5.13** Have a look at the definition of  $\sim_{sss}$ .

**A moment's thought 5.18** By which interleaving can we reach  $x := 1$  as the last assignment?

**A moment's thought 5.21** Have another look at the example above. Will the while loops interfere?

### Chapter 6

**A moment's thought 6.2** What did you answer in **A moment's thought 4.2**? Why?

**A moment's thought 6.4** How was the update operation for environments defined?

- A moment's thought 6.6** Where are values of variables kept ?
- A moment's thought 6.7** Can a Boolean expression be comprised of constituents from other syntactic categories? If yes, which ones?
- A moment's thought 6.9** What does the variable environment tell us about?
- A moment's thought 6.10** Try applying the transition rules to a transition  $env_V, env_P \vdash \langle S, sto \rangle \rightarrow sto'$  where  $S$  is a sequential composition of the form **begin**  $D_V$   $D_P$   $P$  **end**;  $S_2$ . Which bindings are we using for the transition involving  $S_2$ ?
- A moment's thought 6.11** Which procedures do we know when performing a call, when we assume dynamic scope rules for procedures?
- A moment's thought 6.12** How easy is it read a program with dynamic scope rules? And one with static scope rules?
- A moment's thought 6.15** The example must have procedure declarations inside the body of a procedure.

## Chapter 7

- A moment's thought 7.3** Which procedures do we know when  $p$  has been called? Remember that we assume dynamic scope rules for procedures.
- A moment's thought 7.9** Use the rules of the definition of substitution.
- A moment's thought 7.15** What is the binding construct in set abstraction (see Chapter 2)? And in an iterated sum  $\sum_{i=1}^k i^2$ ?

## Chapter 8

- A moment's thought 8.12** Apply the definitions.
- A moment's thought 8.12** Apply the definitions!

## Chapter 9

- A moment's thought 9.6** Do dynamically created objects always survive? Why not?
- A moment's thought 9.9** Which methods are known inside a method?

## Chapter 10

- A moment's thought 10.1** Remember what scope rules tell us about.
- A moment's thought 10.2** What is the relationship between the top of the run-time stack and the active evaluation context?

**A moment's thought 10.3** What did you answer in **A moment's thought 7.3**?

**A moment's thought 10.5** Some sort of correspondence. But which one?

## Chapter 12

**A moment's thought 12.3** What do scope rules tell us?

**A moment's thought 12.4** Find an example where this is the case.

**A moment's thought 12.5** Think of the parameter mechanisms you saw in Chapter 7. What does  $e_1[x \mapsto e_2]$  stand for?

**A moment's thought 12.16** What corresponds to call-by-name in the  $\lambda$ -calculus?

## Chapter 13

**A moment's thought 13.10** Try checking for well-typedness for a small program example and an environment  $E$ . What do you do? When do you need to use the type rules? When do you need  $E$ ?

**A moment's thought 13.26** The example can be very simple.

## Chapter 14

**A moment's thought 14.9** Apply the clauses of the definition.

**A moment's thought 14.10** What would the denotation of a statement be, if  $\mathcal{S}$  was of the first form? And if it was of the second form?

**A moment's thought 14.12** Do we need  $\lambda$ -notation in denotational semantics?

## Chapter 15

**A moment's thought 15.13** Apply Definitions 15.10 and 15.11.

**A moment's thought 15.20** There is an important notion which occurs in the definition of cpos and of continuity. Which notion is that?

**A moment's thought 15.22** Is the real function  $f(x) = -x^3$  monotonic (in the calculus sense)?

**A moment's thought 15.27** Find a calculus textbook which has an 'epsilon-delta'-style definition of continuity.

**A moment's thought 15.28** What is an endofunction? What is a fixed point?

**A moment's thought 15.2** Everything gets turned around - but how?