

CMSC330 Spring 2013 Practice Problems 9 Solutions

1. Operational semantics

Use operational semantics to determine the values of the following OCaml codes:

a. 1

$$\cdot \frac{}{1 \rightarrow 1} \cdot$$

b. + 3 7

$$\frac{3 \rightarrow 3 \quad 7 \rightarrow 7}{+ 3 7 \rightarrow 10}$$

c. + 1 (+ 2 3)

$$\frac{1 \rightarrow 1 \quad \frac{2 \rightarrow 2 \quad 3 \rightarrow 3}{(+ 2 3) \rightarrow 5}}{+ 1 (+ 2 3) \rightarrow 6}$$

d. (fun x = 4) 5

$$\frac{\begin{array}{l} \bullet ; (\text{fun } x = 4) \rightarrow (\bullet, \lambda x. 4) \quad // \text{ evaluate function to produce a closure} \\ \bullet ; 5 \rightarrow 5 \quad // \text{ evaluate the argument} \end{array}}{\frac{(\text{x:}5; 4) \rightarrow 4}{(\text{fun } x = 4) 5 \rightarrow 4}} \quad // \text{ evaluate body of closure, after extending environment w/ binding for parameter}$$

e. (fun x = + x 6) 7

$$\frac{\begin{array}{l} \bullet ; (\text{fun } x = + x 6) \rightarrow (\bullet, \lambda x. + x 6) \quad // \text{ evaluate function to produce a closure} \\ \bullet ; 7 \rightarrow 7 \quad // \text{ evaluate the argument} \end{array}}{\frac{(\text{x:}7; + x 6) \rightarrow 13}{\bullet ; (\text{fun } x = + x 6) 7 \rightarrow 13}} \quad // \text{ evaluate body of closure, after extending environment w/ binding for parameter}$$

f. (fun x = (fun y = + y x)) 8 9

$$\frac{\begin{array}{l} \bullet ; (\text{fun } x = (\text{fun } y = + y x)) \rightarrow (\bullet, \lambda x. (\text{fun } y = + y x)) \quad // \text{ eval func} \\ \bullet ; 8 \rightarrow 8 \quad // \text{ eval arg} \end{array}}{\frac{\text{x:}8; (\text{fun } y = + y x) \rightarrow (\text{x:}8, \lambda y. (+ y x)) \quad // \text{ eval body}}{\bullet ; (\text{fun } x = (\text{fun } y = + y x)) 8 \rightarrow (\text{x:}8, \lambda y. (+ y x)) \quad // \text{ eval func}} \quad // \text{ eval arg}$$

$$\frac{\begin{array}{l} \bullet ; 9 \rightarrow 9 \quad // \text{ eval arg} \\ \text{x:}8, \text{y:}9; (+ y x) \rightarrow 17 \quad // \text{ eval body} \end{array}}{\bullet ; (\text{fun } x = (\text{fun } y = + y x)) 8 9 \rightarrow 17}$$

2. Programming languages

- a. Describe the difference between HTML and XML.

HTML tags are predefined and presentation-oriented, whereas XML tags are user defined and are intended for describing data and metadata.

- b. Describe the difference between query languages and programming languages.

Query languages are designed to make requests to a database or information system, whereas programming languages are designed to express computations that can be performed by a machine.

3. Markup languages

- a. Creating your own XML tags, write an XML document that organizes the following information: 1-hour test on Spanish Monday in Jiménez worth 15%. 1-hour test on Computers Tuesday in CSIC worth 10%. 30-minute test on Computers Friday in AVW worth 5%.

```
<testList>
  <test>
    <length>1 hour</length>
    <subject>Spanish</subject>
    <date>Monday</date>
    <location>Jiménez</location>
    <value>15 % </value>
  </test>
  <test>
    <length>1 hour</length>
    <subject>Computers</subject>
    <date>Tuesday</date>
    <location>CSIC</location>
    <value>10 % </value>
  </test>
  <test>
    <length>30 minute</length>
    <subject>Computers</subject>
    <date>Friday</date>
    <location>A VW</location>
    <value>5 % </value>
  </test>
</testList>
```

or

```
<testList>
  <test subject="Spanish">
    <length unit="hour">1</length>
    ...
  </test>
  <test subject="Computers" >
    <length unit="hour">1</length>
    ...
  </test>
  <test subject="Computers" >
    <length unit="minute">30</length>
    ...
  </test>
</testList>
```