CMPS-112 · Programming Languages · Winter 2012 · Final Exampage 1 of 1

$Id: cmps112-2012q1-exam3.mm,v 1.30 2012-03-15 00:39:39-07 - - $

.PS

examboxes(5)

.PE

No books; No calculator; No computer; No email; No internet; No

notes; No phone. Neatness counts! Do your scratch work elsewhere

and enter only your final answer into the spaces provided.

.EQ

delim $$

.EN

1. Ocaml: Define a function split which takes a predicate and a list

and returns a 2-tuple of lists, where all elements of the first

list cause the predicate to return true, and all other elements

are in the second list. The elements must remain in the same

order as on input. [3pt]

# split;;

- : ('a -> bool) -> 'a list -> 'a list \* 'a list = <fun>

# split even [1; 3; 5; 2; 8; 4; 1; 10];;

- : int list \* int list = ([2; 8; 4; 10], [1; 3; 5; 1])

2. Prolog: Define a function filter which takes three arguments: a

predicate, an input list, and an output list. The output list

contains all elements of the input list for which the predicate is

true, and in the same order. [2pt]

| ?- filter( even, [1,2,3,4,5,6,7,8], X).

X = [2,4,6,8] ?

3. Scheme: Define a function maxzip which takes a predicate and two

lists and zips the lists into a single list by taking the larger

of each of the paired elements. The length of the result is the

same as the length of the shorter list. [3pt]

> (maxzip > '(1 3 5 7 9) '(9 7 5 3 1))

(9 7 5 7 9)

> (maxzip < '(1 3 5 7 9) '(9 7 5 3 1))

(1 3 5 3 1)

> (maxzip <= '(1 3 5 7 9) '(9 9))

(1 3)

4. Perl: Write a program which uses <> to read files and at end

prints the number of characters, words, and lines in these files.

A word is anything that matches /\S+/. [2pt]

% wc.perl foo

4 28 149

5. Name the two general kinds of polymorphism, and for each of them,

name the two sub-kinds of polymporhism into which they may be

classified. [1pt]

6. Scheme: Define a function exclude which takes a count and a list

and returns a list with the first count items removed. A negative

count is the same as 0. If more items are excluded than exist in

the list, return the empty list. [2pt]

> (exclude 2 '(1 2 3 4 5))

(3 4 5)

> (exclude -5 '(1 2 3 4 5))

(1 2 3 4 5)

> (exclude 10 '(1 2 3))

()

7. Ocaml: Define a function exclude which does the same. [2pt]

# exclude 2 [1;2;3;4;5];;

- : int list = [3; 4; 5]

# exclude (-5) [1;2;3;4;5];;

- : int list = [1; 2; 3; 4; 5]

# exclude 10 [1;2;3];;

- : int list = []

8. Prolog: Define A function exclude/3 with the same semantics. The

first two arguments are as before, and the third argument is the

output list. Do not consider the result of backtracking from the

? prompt. [2pt]

| ?- exclude(2,[1,2,3,4,5],U).

U = [3,4,5] ?

yes

| ?- exclude(-5,[1,2,3,4,5],U).

U = [1,2,3,4,5] ?

yes

| ?- exclude(10,[1,2,3],U).

U = [] ?

yes

9. Smalltalk: Define a class Find with a single class method key:

array: which accepts a key and an array and returns the first

position in the array equal to the key. If not found, return V>=

nil. [3pt]

st> Find key: 5 array: #(1 3 5 7 9).

3

st> Find key: 11 array: #(1 3 5 7 9).

nil

10. Java: Finish the following program by specifying the class >V=

say . When started from the main function, it prints the message

``hello'' and then quits. [2pt]

class hello {

// What goes here?

public static void main (String[] args) {

Thread say = new Thread (new say ());

say.start();

}

}

11. Give an example of how memory leak might occur in Java. [2pt]

12. Smalltalk: Define the class Stack. Internally it has an array of

fixed size and no attempt is made to verify pre- or post-

conditions. It simply crashes on overflow or underflow. Define

the following methods: [6pt]

(a) Class method new uses new: to create a stack of maximum

capacity 10.

(b) Class method new: creates a stack of the size given by its

argument.

(c) Instance method init: initializes the array representation

and sets the top to 0

(d) Instance method pop removes and returns the top item on the

stack.

(e) Instance method push: pushes a new item onto the top of the

stack.

(f) Instance method empty reports on whether the stack is empty

or noT.

bash-3.2$ cat stack.test.st

FileStream fileIn: 'stack.st'.

s := Stack new.

s push: 1; push: 5; push: 10.

s inspect.

[s empty not] whileTrue: [

stdout << s pop << Character nl].

bash-3.2$ gst <stack.test.st

An instance of Stack

array: (1 5 10 nil nil nil nil nil nil nil )

top: 3

10

5

1

Multiple choice. To the left of each question, write the letter that

indicates your answer. Write Z if you don't want to risk a wrong

answer. Wrong answers are worth negative points. [11pt]

+--------------------------+------+------+------------+

|number of | |× 1 = | $= a$ |

|correct answers | | | |

+--------------------------+------+------+------------+

|number of | |× ½ = | $= b$ |

|wrong answers | | | |

+--------------------------+------+------+------------+

|number of | |× 0 = | 0 |

|missing answers | | | |

+--------------------------+------+------+------------+

|column total | 11 | | $= c$ |

|$ c = max ( a - b , 0 ) $ | | | |

+--------------------------+------+------+------------+

1. What will make Smalltalk print 9?

(A) (4 + 5) value.

(B) (4 + 5) value:.

(C) [4 + 5] value.

(D) [4 + 5] value:.

2. In Smalltalk, what is 1.4142135623730951?

(A) (sqrt 2)

(B) 2 \*\* .5

(C) 2 sqrt

(D) sqrt (2)

3. In Ocaml, what is the type of List.tl? (Hint: like cdr in

Scheme).

(A) 'a list \* 'a list -> 'a list

(B) 'a list -> 'a

(C) 'a list -> 'a list

(D) 'a list -> 'a list -> 'a list

4. What kind of type equivalence is used to determine if two

different typedefs in C declare the same type?

(A) anonymous

(B) name

(C) structural

(D) value

5. A process that has exited, either by calling exit or from a

signal, but has not yet been waited for by its parent process is

called a:

(A) daemon

(B) fork bomb

(C) init

(D) zombie

6. In Perl, the default argument to a function requiring an argument,

when none is given, is:

(A) $!

(B) $0

(C) $\_

(D) @\_

7. Which of the following functions is a higher-order function whose

arguments are a function and a list, and whose result is a list

containing the result of applying the function to each of the

elements of the list?

(A) filter

(B) foldl

(C) foldr

(D) map

8. Which of the following functions can take a function, a unit, and

a list as arguments, and which applies the function between each

element of the list, along with the unit at one end, and which can

use up constant stack space?

(A) filter

(B) foldl

(C) foldr

(D) map

9. How might one declare an array variable in Perl with lexical

scope?

(A) local @a;

(B) my @a;

(C) our @a;

(D) use @a;

10. Which of the following programs will cause a dangling pointer?

(A) int \*f() {int i = 6; return &i; }

(B) int \*f() {int i = 6; return \*i; }

(C) int \*f() {int i = 6; return i; }

(D) int f() {int i = 6; return i; }

11. In PL/I, a goto statement had the capability of being executed in

one function and transver control to another function, perhaps the

one that called it. The equivalent feature of Java uses what

keyword?

(A) break

(B) continue

(C) throw

(D) synchronized

Multiple choice. To the left of each question, write the letter that

indicates your answer. Write Z if you don't want to risk a wrong

answer. Wrong answers are worth negative points. [11pt]

+--------------------------+------+------+------------+

|number of | |× 1 = | $= a$ |

|correct answers | | | |

+--------------------------+------+------+------------+

|number of | |× ½ = | $= b$ |

|wrong answers | | | |

+--------------------------+------+------+------------+

|number of | |× 0 = | 0 |

|missing answers | | | |

+--------------------------+------+------+------------+

|column total | 11 | | $= c$ |

|$ c = max ( a - b , 0 ) $ | | | |

+--------------------------+------+------+------------+

1. In Java, if two functions have the same name in the same class,

but have different signatures, this is referred to as:

(A)

2. In Java, if two functions in different classes have the same

signature, but one of the classes is a subclass of another, this

is referred to as:

(A)

3. Allowing partial parameterization of a function in a functional

language such as Ocaml is called:

(A) currying

(B) lambda lifting

(C) tupling

(D) unification

4. In an object-oriented language like C++, a virtual function

(instance method) is called based on a:

(A) duck-typing response

(B) generic declaration

(C) heap-allocated closure

(D) virtual function table

5. Which of the following data structures violates the spirit of

functional programming?

(A) array

(B) list

(C) stack

(D) tree

6. All imperative featurs of Haskell must be isolated from the rest

of the program and contained in a:

(A) closure

(B) monad

(C) proxy

(D) thunk

7. Unification is an important algorithm in performing automatic type

inference in which of these languages?

(A) Java

(B) Ocaml

(C) Prolog

(D) Scheme

8. Given the declarations int \*p; and int i;, which C expression is

not valid?

(A) i + i

(B) i + p

(C) p + i

(D) p + p

9. From what memory segment does the malloc(3) function allocate

memory?

(A) test

(B) data

(C) heap

(D) stack

10. A process that sleeps in the background and wakes up whenever a

request is made on its port, then performs that service, and

returns to sleep to wait for the next request is called a:

(A) daemon

(B) fork bomb

(C) init

(D) zombie

11. The first language to be described using Backus-Naur form was:

(A) Algol 60

(B) Basic

(C) Cobol

(D) Fortran