CS 131

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Today

Questions on HW

Questions on Midterm

Sample Midterm

Review of course material

Java Memory Model

This Class

homework 3 is due **Monday Oct. 30 at 23:55**

This homework will be graded with automated scripts

- not compiling → no credit

- can use whatever class names you'd like as long as the main class works as expected

- your code should behave exactly according to the spec

- if developing locally, test your homework out on SEASnet before submitting

- check Piazza for clarifications

HW3 Questions

Midterm

Next Week Wednesday Nov. 1

Same room as lecture

Same time

Open books, open notes

- bring everything

- print out homeworks, solutions

- notes from class, sections

- textbook

- anything non-electronic

Go over all class notes

Go over all HW problems again

Everything covered so far is on the table

- including HW1, 2, 3

Questions about the Midterm

Sample Midterm Question 1

"Ireland has leprechauns galore." Is an example of a particular kind of syntactic construct in English. Can you construct a similar example in in C++, OCaml, or Java? If so, give an example; if not, explain why not.

Sample Midterm Question 2a

Write an OCaml function 'twice' that accepts a function f and returns a function g such that g(x) equals f(f(x)).

For simplicity's sake, you can assume that f is free of side effects, and you can impose other restrictions on f and x. Try to keep the restrictions as minor as possible, and explain any restrictions you impose. Or, if 'twice' cannot be written easily OCaml, explain why not.

Sample Midterm Question 2b

Same as (a), except write a function 'half' that accepts a function f and returns a function g such that f(x) equals g(g(x)).

If 'half' can't be written in OCaml, explain why not

Sample Midterm Question 2c

Give the types of 'twice' and 'half'

Sample Midterm Question 3

Consider the following grammar for a subset of the C++ language.

> expression:
>> expression ? expression : expression
>>
>> expression != expression
>>
>> expression + expression
>>
>> ! expression
>>
>> INTEGER-CONSTANT
>>
>> (expression)

For example, (!!0+1!=2 ? 3 : 4) is read as "if not-not-0 plus 1 does not equal 2, then 3, else 4", and evaluates to 4.

Sample Midterm Question 3a

expression:

expression ? expression : expression

expression != expression

expression + expression

! expression

INTEGER-CONSTANT

(expression)

What are the tokens of this subset of C++?

Sample Midterm Question 3b

expression:

expression ? expression : expression

expression != expression

expression + expression

! expression

INTEGER-CONSTANT

(expression)

Show that this grammar is ambiguous

Sample Midterm Question 3c

expression:

    expression ? expression : expression

    expression != expression

    expression + expression

    ! expression

    INTEGER-CONSTANT

    (expression)

Rewrite the grammar so that it is no longer ambiguous, resolving any ambiguities in the same way that C++ does. Recall that in C++, the expression

(0 != 1 != 2 || 3 + !4 + 5 || 6 ? 7 : 8 ? 9 : 10)

is treated like

(((((0 != 1) != 2) || ((3 + (!4)) + 5)) || 6) ? 7 : (8 ? 9 : 10))

Sample Midterm Question 3d

Translate the rewritten diagram into a syntax diagram

Sample Midterm Question 4

A numerical analyst is really bothered by the special values of IEEE floating point, and asks you to modify C++ to fix what she views as a serious conceptual flaw.

She wants her C++ programs to throw an exception instead of returning infinities and NaNs.

Is her request reasonable for C++ programs?

Is it implementable?

Why or why not?

Don't worry about compatibility with existing compilers, etc.; assume that you are the inventor of C++ and she is asking for this feature early in your language design process.

Sample Midterm Question 5

Give an example of four distinct Java types A, B, C, D such that A is a subtype of B, A is a subtype of C, B is a subtype of D, and C is a subtype of D. Or, if such an example is impossible, explain why not.

Sample Midterm Question 6

Explain how you would implement OCaml-style type checking, in an implementation that uses dynamic linking heavily. What problems do you foresee in programs that relink themselves on the fly?

Sample Midterm Question 7a

Write a curried OCaml function **interleave C S L1 L2**

- that constructs a new list L from the lists L1 and L2, using the chooser C with seed S,

- and returns a pair (S1, L), where S1 is the resulting seed and L is the interleaved list.

- interleave C S [1;2] [3;4;5] might invoke C four times and then return (S1, [1;3;4;2;5]).

chooser:

- function that accepts a a pseudorandom seed s

- returns a pair (r,s1) where r is a pseudorandomly chosen boolean value (with true and false being equally likely) and s1 is a new pseudorandom seed that can be passed to the chooser.

Sample Midterm Question 7a

Write a function "outerleave" that does the opposite of what "interleave does":

it splits a list into two sublists that can be interleaved to get the original list, and returns a triplet consisting of the new seed and the two sublists.

"outerleave C S [1;3;4;2;5]" might yield (S1, [1;3;2], [4;5]).

If given a list of length N, "outerleave" always invokes the chooser N times.

Sample Midterm Question 7c

Give the data types of all top-level values or functions defined in your answer to (a) and (b). If you did not finish (a) and (b), give the best answer you can, and state your assumptions about what a solution would look like.

Course Material Covered so Far

OCaml

- recursion and tail recursion

- functions as data/higher order functions

- type inference

- pattern matching

Course Material Covered so Far

Grammars

- (E)BNF

- Railroad diagrams

- Ambiguity

Course Material Covered so Far

Java

- Inheritance

- Memory Model