Programming Abstractions

Week 9-2: Exam 2 Review

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Exam Format

n mostly conceptual problems

- Mostly short answer
- There may be code or code snippets you have to write

1 extra credit problem

You may write code in DrRacket, but everything will be entered in Blackboard

Exam will be released at midnight EDT on Thursday

Your solutions are due by 23:59 EDT on Thursday

Class time

During Thursday's class, I will be in the class's Zoom meeting, feel free to hang out in there

If you have a question, send me a private chat either with the question itself or just say "I have a question" and I'll bring you into a breakout room and you can ask your question privately there

Possible question topics

Programming language issues

- Backtracking
  - Single solution
  - All solutions
- Data types
- Environments
- Lexical vs. dynamic binding
- Parameter passing mechanisms
  - Pass by value
  - Pass by reference
  - Pass by name
- Closures

Possible question topics

Interpreter project

- Datatypes for various constructs (literals, variables, if-then-else, let, applications)
- Environment implementation
- How specific expressions are parsed and evaluated
- What would happen if we did something differently

Consider a new data type that is a sorted list. What should the constructor of the sorted list be? `(sort lst proc)` will return the list `lst` sorted by `proc`. E.g., `(sort '(1 3 2 5) <)` returns the list `'(1 2 3 5)`

A.
```
(define (sorted-list lst)
  (list 'sorted-list lst))
```

B.
```
(define (sorted-list lst)
  (sort lst <))
```

C.
```
(define (sorted-list lst)
  (list 'sorted-list (sort lst <)))
```

D.
```
(define (sorted-list lst)
  (cons 'sorted-list (sort lst <)))
```

When parsing a let expression which pieces of information does the parse tree need to store?

A. An extended environment mapping the symbols in the binding list to their values and the body expression

B. A list of binding symbols, list of parse trees for the binding expressions, and the body expression

C. A list of binding symbols, a list of binding values, and the body expression

D. Any of A, B, or C work

E. Either B or C work, but not A

Recall that application expressions `(proc exp1 ... expn)` work by evaluating the proc expression and then each of the argument expressions in order before calling the procedure.

In a language without mutation (e.g., all of MiniSchemes A–E do not have mutation), it doesn't matter what order the expressions are evaluated in; the result will be the same. What about a language that supports `set!`, does order matter then? Why or why not?

A. Yes it matters

B. No it doesn't matter

C. It depends

What is the value of the expression assuming lexical binding? What about dynamic binding?

```
(let* ([x 10]
       [f (λ (z) (* x z))])
  (let ([x 20])
    (f x)))
```

A. Lexical: 100
   Dynamic: 100

B. Lexical: 100
   Dynamic: 200

C. Lexical: 200
   Dynamic: 100

D. Lexical: 200
   Dynamic: 200

E. Lexical: 200
   Dynamic: 400

Consider this Python-like code snippet

```
def foo(x):
    x += 10
    return x + 1
def main():
    y = 1
    z = foo(y)
    print(y+z)
```

What is printed by main assuming pass-by-value? Assuming pass-by-reference?

A. Value: 13
   Reference: 13

B. Value: 13
   Reference: 23

C. Value: 13
   Reference: 24

D. Value: 23
   Reference: 24

Why do we have multiple environments? Why not just have a single environment where we update the bindings for each let expression or procedure call?

A latin square is an n x n array filled with n different symbols, each occurring exactly once in each row and in each column. E.g.,

A	B	C
C	A	B
B	C	A

is a 3 x 3 latin square.

An n x n latin square can be found using backtracking. What should the `feasible` procedure do to check if the next cell in a partial solution can (potentially) be set to the next value?

In other words, given a partial solution, e.g.,

A	B	C
C		

, and a symbol, how would you check if the symbol could be assigned to the next open cell in the square (the center cell in this example)?