

CMSC330 Spring 2021 Final Exam Solutions

1. PL Concepts

- 1.1. “Goodbye!”, “Goodbye!”
- 1.2. It translates a program from one language to another (1/2 point given for answer B)
- 1.3. Ruby
- 1.4. “It determines reachability incrementally, as the program executes” AND “Memory can be freed immediately once it becomes unreachable”
- 1.5. “A Java interface only applies to classes that explicitly declare it, but a Rust trait can be applied to any type”
- 1.6. “uniq should return a list of the same length whether given a list or its reverse”, “List of small integers”

2. Ruby

- 2.1. #1: “yield grade”
#2: “0”
- 2.2. x["3xx"] = [330, 351]
- 2.3. /^a([0-9a-zA-Z]{2})z\$/
- 2.4. #1: collect OR map
#2: val/2
- 2.5. #1: attr_reader :n, :m
#2: “#{n} + #{m}i”

3. OCaml

- 3.1. fun a -> 0
- 3.2. fun a b -> match b with [] -> failwith “” | h::_ -> [h a]
- 3.3. error, z is used both as int and bool
- 3.4. x+1 (many correct answers)
- 3.5. [6;0;4]
- 3.6. #1: min x lst
#2: []
#3: h::t

4. DFA/NFA

- 4.1. (ab⁺)+(a^{*}b^{*})
- 4.2. ab, aba
- 4.3. 2, 3
- 4.4. 2, 3, 4
- 4.5. 4
- 4.6. X, Y, Z
- 4.7. The third one

5. CFG and Parsing

- 5.1. False
- 5.2. False
- 5.3. $S \rightarrow T \rightarrow TT \rightarrow TTT \rightarrow cTT \rightarrow ccT \rightarrow ccc$
 $S \rightarrow SS \rightarrow TS \rightarrow cS \rightarrow cSS \rightarrow cTS \rightarrow cTT \rightarrow ccT \rightarrow ccc$
- 5.4. $Exp \rightarrow Add \rightarrow Mul \rightarrow Primary * Mul \rightarrow ID * Mul \rightarrow x * Mul \rightarrow x * Primary$
 $\rightarrow x * Int \rightarrow x * 2$

6. Security

- 6.1. Buffer overflow
any number >49
add "if (n>49){n=49}" before line 5
- 6.2. The size of the buffer is part of the type, and the compiler adds bounds checks before memory is accessed

7. Rust

- 7.1. #1: any int type (i32, u32, etc)
#2: mut
#3: i -= 1
- 7.2. if let Flavor::Savory = self.flavor { "savory" } else { "sweet" }
- 7.3. a
- 7.4. the value is dropped (this question is not counted due to the mistake)
- 7.5. make my_string mutable by adding "mut" keyword, pass "&mut my_string" to do_stuff, and change arg type of do_stuff to be "&mut String"
- 7.6. 4, 7
- 7.7. 9, 10

8. Lambda Calculus

- 8.1. A, D
- 8.2. A
- 8.3. B
- 8.4. It never reaches a normal form
- 8.5. To implement recursion