CSE216
Programming Abstraction

Instructor: Zhoulai Fu

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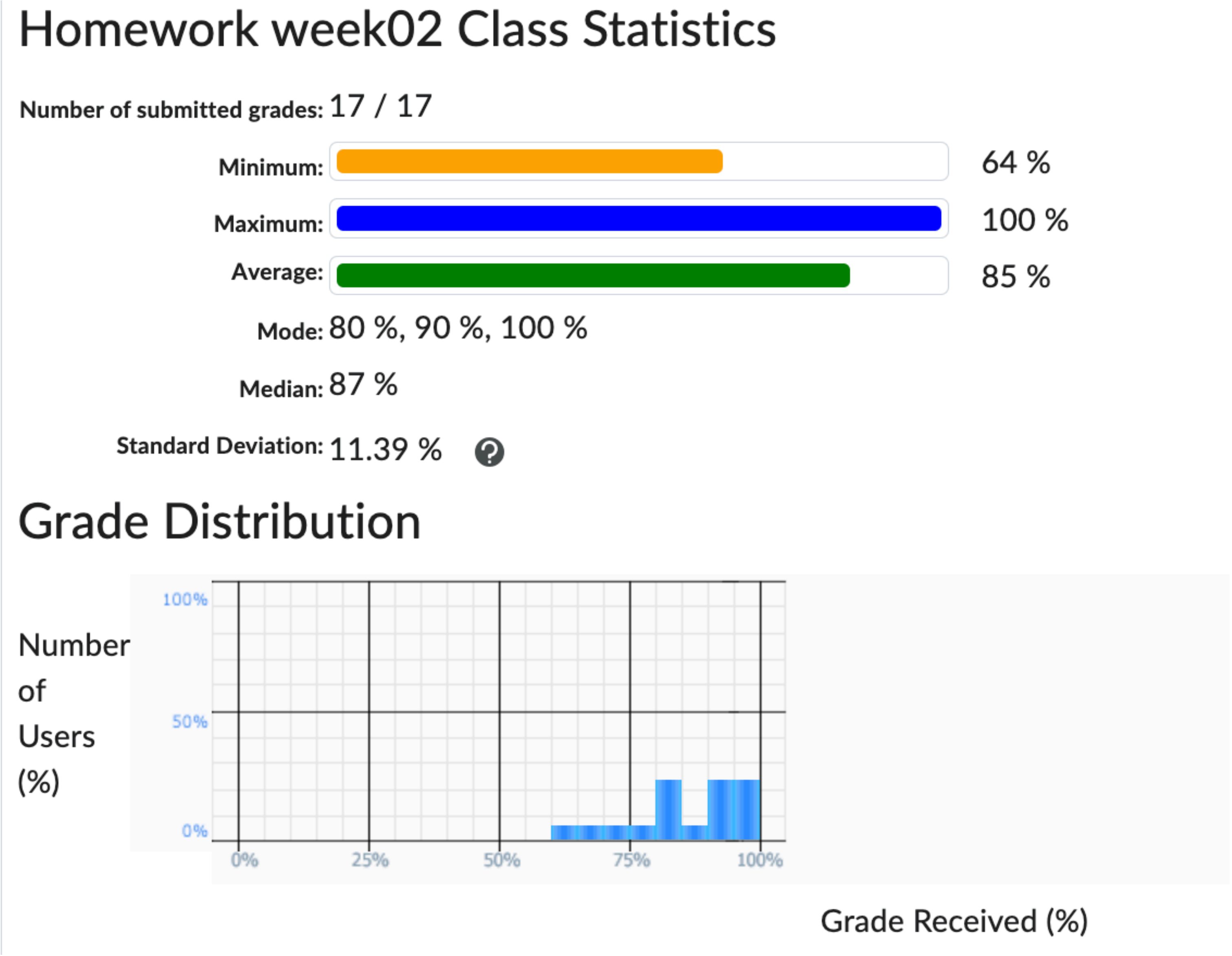


Homework week02 Class Statistics

Number of submitted grades: 17 / 17

Minimum: 64 %

Maximum: 100 %

Average: 85 %

Mode: 80 %, 90 %, 100 %

Median: 87 %

Standard Deviation: 11.39 %

Grade Distribution

Homework week02

1. What does the regular expression `\d{3}-\d{2}-\d{4}` match?

   a) A phone number in the format (xxx) xxx-xxxx

   b) An email address

   c) A date in the format mm/dd/yyyy

   d) A Social Security number in the format xxx-xx-xxxx

2. What does the regular expression `[a-z]\d*` match?

   a) Any word containing only lowercase letters

   b) Any word containing only uppercase letters

   c) Any word containing only numbers

   d) Any word containing only a lowercase letter followed by optional digits

3. What does the regular expression `\d{3}-\d{3}-\d{4}|\d{10}` match?

   a) A Social Security number in the format xxx-xxx-xxxx or a 10-digit phone number

   b) A date or a phone number

   c) A phone number or an email address

   d) A Social Security number or an email address

4. What does the regular expression `[a-z]+?@[a-zA-Z_]+?.[a-zA-Z]{2,3}` match? Choose the closest answer.

   a) A phone number

   b) An email address

   c) A URL

   d) A street address

5. Please conduct some research. Your task is to determine the Linux command that can recursively search for all markdown files (with the ".md" extension) in the current directory that contains a negative integers. Note: to match the minus symbol, you can use `\-` or `[-]`. The following should be recognized: -89, -1, -007. The following should not be recognized: 0, -x, 42. A good starting point for your investigation might be familiarizing yourself with the `grep` command. You can refer to the Wikipedia page on grep for an overview.

6. What is the language generated by the following grammar? `S -> aSb | ε`

   A. The set of all strings that with 'a' and end with `b`.

   B. The set of all strings that contain an equal number of 'a's and 'b's.

   C. The set of all strings that contain an even number of 'a's followed by an even number of 'b's.

   D. The set of all strings that contain n 'a's followed by m 'b's, where n = m >= 0

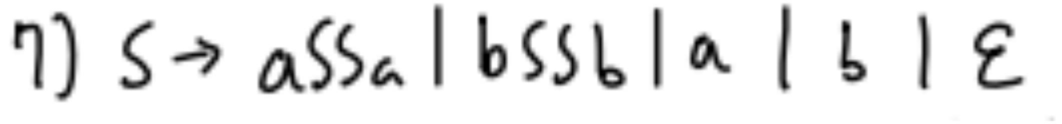
7. Create a grammar that generates all strings over {a, b} that start and end with the same symbol.

8. Given the grammar with the following productions:

   ```
   S -> aSbb | ε
   ```

   Determine the language generated by the grammar.

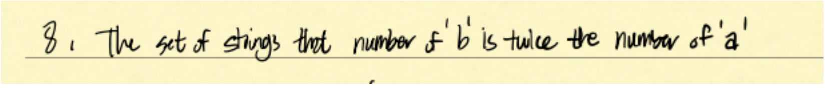
Common mistake in #7



7) $S \to aSSa \mid bSSb \mid a \mid b \mid \varepsilon$

Not accepting aabbba

Common mistake in #8



8. The set of strings that number of 'b' is twice the number of 'a'

9. Given the following grammar

```
E -> E + E | E * E | id
```

Draw different parse trees for the string id + id * id to demonstrate ambiguity.

10. Given the following grammar

```
S -> aAb
A -> c | d
```

Can acb, adb, adab, aab, ab be parsed? Give an answer for each but you do not need to explain.

Column 1	Can be parsed (true/false)
acb	
adb	
adab	
aab	
ab	

solution

1. What does the regular expression `\d{3}-\d{2}-\d{4}` match?

    a) A phone number in the format (xxx) xxx-xxxx

    b) An email address

    c) A date in the format mm/dd/yyyy

    [✓ d)] A Social Security number in the format xxx-xx-xxxx

2. What does the regular expression `[a-z]\d*` match?

    a) Any word containing only lowercase letters

    b) Any word containing only uppercase letters

    c) Any word containing only numbers

    [✓ d)] Any word containing only lowercase letters followed by optional digits

3. What does the regular expression `\d{3}-\d{3}-\d{4}|\d{10}` match?

    [✓ a)] A Social Security number in the format xxx-xxx-xxxx or a 10-digit phone number

    b) A date or a phone number

    c) A phone number or an email address

    d) A Social Security number or an email address

4. What does the regular expression `[a-z]+?@[a-zA-Z_]+?.[a-zA-Z]{2,3}` match?

   a) A phone number

   [✓ b) An email address]

   c) A URL

   d) A street address

5. Please conduct some research. Your task is to determine the Linux command that can recursively search for all markdown files (with the ".md" extension) in the current directory that contains a negative integers. Note: to match the minus symbol, you can use `\-` or `[-]`. The following should be recognized: -89, -1, -007. The following should not be recognized: 0, -x, 42. A good starting point for your investigation might be familiarizing yourself with the `grep` command. You can refer to the Wikipedia page on grep for an overview.

   grep "[-][0-9][0-9]*" *.md

6. What is the language generated by the following grammar? S -> aSb | ε

A. The set of all strings that with 'a' and end with b.

B. The set of all strings that contain an equal number of 'a's and 'b's.

C. The set of all strings that contain an even number of 'a's followed by an even number of 'b's.

[✓ D.] The set of all strings that contain n 'a's followed by m 'b's, where n = m >= 0

7. Create a grammar that generates all strings over {a, b} that start and end with the same symbol.

7. $S \to {}_aQ_a \mid {}_bQ_b \mid a \mid b \mid ε$

$Q \to {}_aQ \mid Q_a \mid {}_bQ \mid Q_b \mid ε$

8. Given the grammar with the following productions:

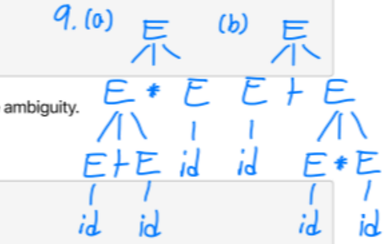
```
S -> aSbb | ε
```

The set of all strings that contain n 'a's followed by m 'b's, where m=2n>=0.

Determine the language generated by the grammar.

9. Given the following grammar

```
E -> E + E | E * E | id
```



Draw different parse trees for the string id + id * id to demonstrate ambiguity.

10. Given the following grammar

```
S -> aAb
A -> c | d
```

Can acb, adb, adab, aab, ab be parsed? Give an answer for each but you do not need to explain.

Column 1	Can be parsed (true/false)
acb	true
adb	true
adab	false
aab	false
ab	false

Exercises

Small-1

- $(\lambda\ x.x)\ a$

- $(\lambda\ x.y)\ a$

- $(\lambda\ x.xy)\ a$

- $(\lambda\ x.\ yx)\ a$

- $(\lambda\ x.\ xx)\ a$

- $(\lambda\ x.\ yy)\ a$

Small-2

- (λ x.x) a b
- (λ x.y) a b
- (λ x.xy) a b
- (λ x. yx) a b
- (λ x. xx) a b
- (λ x. yy) a b

Small-3

- $(\lambda x.x)\ \lambda a.\ b$
- $(\lambda x.y)\ \lambda a.\ b$
- $(\lambda x.xy)\ \lambda a.\ b$
- $(\lambda x.\ yx)\ \lambda a.\ b$
- $(\lambda x.\ xx)\ \lambda a.\ b$
- $(\lambda x.\ yy)\ \lambda a.\ b$

Small-4

- (λ x.x) x
- (λ x.y) x
- (λ x.xy) x
- (λ x. yx) x
- (λ x. xx) x
- (λ x. yy) x

Small-5

- (λ x.x) x y
- (λ x.y) x y
- (λ x.xy) x y
- (λ x. yx) x y
- (λ x. xx) x y
- (λ x. yy) x y

Exercise: beta reduction

- $(\lambda z.z)\ (\lambda z.z\ z)\ (\lambda z.z\ q)$

Exercise: beta reduction

- (λs.λq.s q q) (λa.a) b

Exercise: beta reduction

- (λs.λq.s q q) (λq.q) q

Exercise: beta reduction

- ((λs.s s) (λq.q)) (λq.q)

Exercise: beta reduction

- $(\lambda\ x.\lambda y.x)\ x\ y$

Exercise: beta reduction

- (λ x. λ y. λ z. y (w y x)) λ s. λ z. z