CS1101 Programming and Problem Solving

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Spring 2023

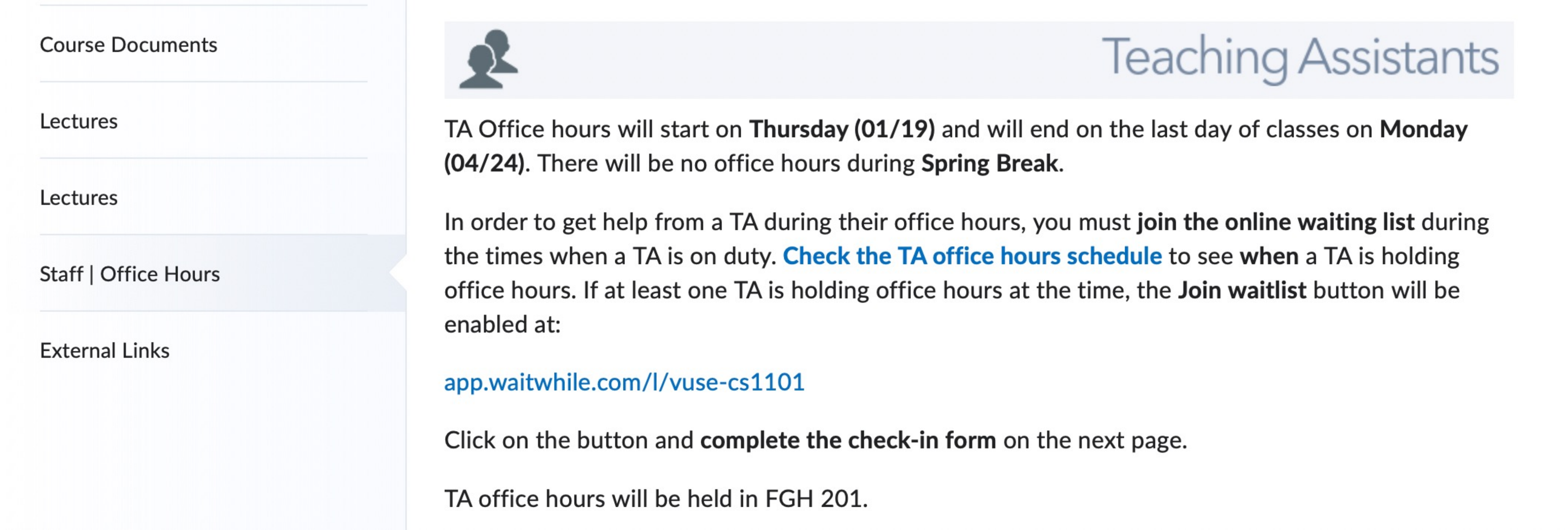
Logistics

- **PA00-A** and **PA00-B** on **zyBook > Chap 11**
  - Due: Thursday, Jan 19, at 11:59pm

- **ZY-1** and **ZY-2A** on **zyBook > Assignments**
  - Due: Saturday, Jan 21, at 11:59pm

Logistics

- TA office hours will start on Thursday, Jan 19.
  - Brightspace > Content > Staff | Office Hours



Teaching Assistants

TA Office hours will start on **Thursday (01/19)** and will end on the last day of classes on **Monday (04/24)**. There will be no office hours during **Spring Break**.

In order to get help from a TA during their office hours, you must **join the online waiting list** during the times when a TA is on duty. **Check the TA office hours schedule** to see **when** a TA is holding office hours. If at least one TA is holding office hours at the time, the **Join waitlist** button will be enabled at:

app.waitwhile.com/l/vuse-cs1101

Click on the button and **complete the check-in form** on the next page.

TA office hours will be held in FGH 201.

Recap – Identifiers

Q: Which of the following is/are legal Java identifier(s)?

[✓ A. Temp_X]

B. Site-Num

C. Tax%

[✓ D. t1]

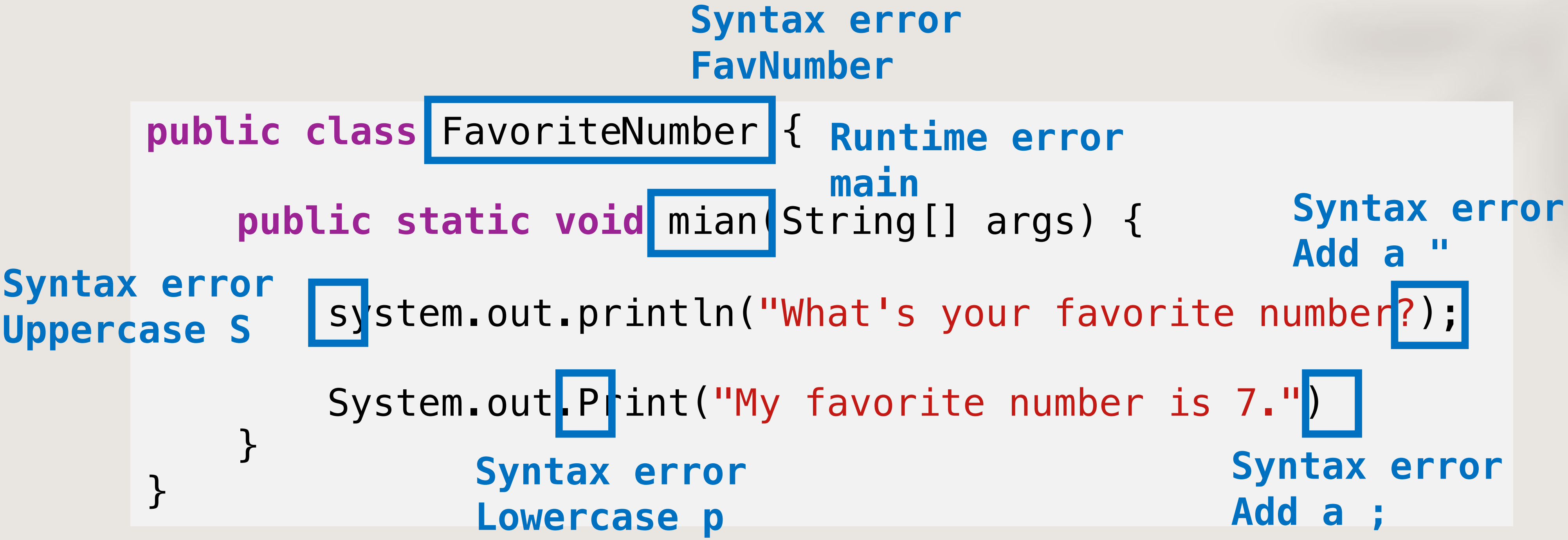
E. 1t

F. int

Recap – Program Errors

• Syntax Errors	Compile? ✗	Run? ✗
• Runtime Errors	Compile? ✓	Run? ✗
• Logic Errors	Compile? ✓	Run? ✓

Q: Identify the six program errors in FavNumber.java, and specify the following for each error: 1) location, 2) type, 3) how to fix



```
public class FavoriteNumber {

    public static void mian(String[] args) {

        system.out.println("What's your favorite number?);

        System.out.Print("My favorite number is 7.")
    }
}
```

Syntax error
FavNumber

Runtime error
main

Syntax error
Add a "

Syntax error
Uppercase S

Syntax error
Lowercase p

Syntax error
Add a ;

Recap – Primitive Data Types

- **int** – integer
  - 0, -1, 365, 20230118
- **double** – floating point
  - **0.0**, 0.9, 3.14159, -21.9, -0.2, **9.4e3**
- **char** – character
  - 'A', 'a', '#', '\n'
- **boolean**
  - true, false

If a number is a double, there is at least one decimal place listed

9.4e3 is equivalent to **9.4 x 10**^{3}

char uses **single quotes**
String uses **double quotes**

Expressions

zyBook Chap 2.10, 2.11, 2.12, 2.13, 2.14

Expression

A simple value or set of operations that produces a value

- **Operator** → indicates the operation to be performed
- **Operand** → value in the expression
- E.g.
  - **(3 + 29) - (4 * 5)**

Arithmetic Operators

- Addition Operator: +
- Subtraction Operator: -
- Multiplication Operator: *
- Division Operator: /
- Remainder Operator: %

Division & Remainder – int

Dividend = Divisor × Quotient + Remainder

Q: Find the resulting value of …

- 1 / 4 **= 0 (1 = 4 x 0 + 1)**
- 1 % 4 **= 1 (1 = 4 x 0 + 1)**
- 0 / 4 **= 0**
- 0 % 4 **= 0**
- 101 / 4 **= 25**
- 101 % 4 **= 1**

Division & Remainder – double

Q: Find the resulting value of …

- 0.77 / 0.25 **= 3.08 (0.77 = 0.25 x 3.08)**
- 0.77 % 0.25 **= 0.02 (0.77 = 0.25 x 3 + 0.02)**

With the **remainder** operator, Java will try to find how many times the dividend **completely (whole number)** goes into the divisor; and then generates the **remaining value**.

Precedence

- Precedence:
  - The binding power of an operator, which determines how to group parts of an expression. That is, the order of evaluating the operations
- **Evaluate left to right**. Therefore, if two operations are at the same precedence order, evaluation from left to right, and
  1. Parentheses: ()
  2. Unary operators: +, -
  3. Multiplicative operators: *, /, %
  4. Additive operators: +, –

Precedence:

1. Parentheses: ()
2. Unary operators: +, -
3. Multiplicative operators: *, /, %
4. Additive operators: +, –

Q:

$$\underbrace{50 - \underbrace{\underbrace{7 * 5}_{35} \% 2}_{1} + \underbrace{(13 / 6)}_{2}}_{50 - 1 + 2 = 51}$$

Mixing Types – Promotion/Coercion

Promotion

- A **widening** primitive **conversion** that **does not lose** information about the value
  - E.g., converting an integer 4 to a double 4.0 does not lose any information
- **Occurs automatically** to the integers operands whenever there is at least one operand that is **double**
  - E.g., **23.0** / **4** → 23.0 / **4.0** = 5.75

Precedence:

1. Parentheses: ()
2. Unary operators: +, -
3. Multiplicative operators: *, /, %
4. Additive operators: +, –

Q: $$\underbrace{5.0 / (\underbrace{6 - \underbrace{4 \% 6}_{4}}_{2})}_{5.0 / 2.0 = 2.5}$$

Q: $$\underbrace{\underbrace{\underbrace{7 / 3}_{2} * 1.2}_{2.0 * 1.2 = 2.4} + \underbrace{3 / 2}_{1}}_{2.4 + 1.0 = 3.4}$$

Mixing Types – Casting

Casting

- A **narrowing** primitive **conversion** that **may lose** information about the value (**truncating**)
  - E.g., converting a double 4.1 to an integer 4 loses the information after the decimal point
- **Requires cast** via the syntax of `(target type) <value>`
  - (int) 4.16 = 4
  - (int) 4.75 = 4

Mixing Types – Casting

Casting

- Only casts value **immediately following cast**
    - 23 / 2 = 11
    - **(double) 23 / 2**

      → **23.0 / 2**   (23 is cast to double, that is, 23.0)

      → **23.0 / 2.0 = 11.5** (2 is automatically promoted to 2.0 since there's a double 23.0 in the expression)
    - **(double) (23 / 2)**

      → **(double) 11 = 11.0** (parentheses have the highest precedence)

Q: Assuming there are books that are 0.15 feet wide, write an expression that evaluates the number of books that will fit on a bookshelf that is 2.5 feet wide.

```
(int) (2.5 / 0.15) = 16
```

General Rule

- When the arithmetic operators are performed on two integers, the result will be an integer.

- When an arithmetic operation is performed on at least one real number (double), the result will be a real number (double).