(Optional) `printf`

reading: 4.3

Formatting text with `printf`

```
System.out.printf("format string", parameters);
```

- A format string can contain *placeholders* to insert parameters:
  - `%d`   integer
  - `%f`   real number
  - `%s`   string
    - these placeholders are used instead of + concatenation

  - Example:
    ```
    int x = 3;
    int y = -17;
    System.out.printf("x is %d and y is %d!\n", x, y);
                      // x is 3 and y is -17!
    ```

    - `printf` does not drop to the next line unless you write `\n`

printf width

- %**W**d   integer, **W** characters wide, right-aligned
- %-**W**d   integer, **W** characters wide, *left*-aligned
- %**W**f   real number, **W** characters wide, right-aligned
- ...

```java
for (int i = 1; i <= 3; i++) {
    for (int j = 1; j <= 10; j++) {
        System.out.printf("%4d", (i * j));
    }
    System.out.println();   // to end the line
}
```

Output:
```
   1   2   3   4   5   6   7   8   9  10
   2   4   6   8  10  12  14  16  18  20
   3   6   9  12  15  18  21  24  27  30
```

`printf` precision

- `%.`**D**`f`   real number, rounded to **D** digits after decimal
- `%`**W**`.`**D**`f`   real number, **W** chars wide, **D** digits after decimal
- `%-`**W**`.`**D**`f`   real number, **W** wide (left-align), **D** after decimal

```
double gpa = 3.253764;
System.out.printf("your GPA is %.1f\n", gpa);
System.out.printf("more precisely: %8.3f\n", gpa);
```

Output:

```
your GPA is 3.3
more precisely:    3.254
```

3

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printf question

- Modify our `Receipt` program to better format its output.
  - Display results in the format below, with 2 digits after .

- Example log of execution:

```
How many people ate? 4
Person #1: How much did your dinner cost? 20.00
Person #2: How much did your dinner cost? 15
Person #3: How much did your dinner cost? 25.0
Person #4: How much did your dinner cost? 10.00

Subtotal:   $70.00
Tax:        $5.60
Tip:        $10.50
Total:      $86.10
```

printf answer (partial)

```
...
    // Calculates total owed, assuming 8% tax and 15% tip
    public static void results(double subtotal) {
        double tax = subtotal * .08;
        double tip = subtotal * .15;
        double total = subtotal + tax + tip;

        // System.out.println("Subtotal: $" + subtotal);
        // System.out.println("Tax: $" + tax);
        // System.out.println("Tip: $" + tip);
        // System.out.println("Total: $" + total);

        System.out.printf("Subtotal: $%.2f\n", subtotal);
        System.out.printf("Tax:      $%.2f\n", tax);
        System.out.printf("Tip:      $%.2f\n", tip);
        System.out.printf("Total:    $%.2f\n", total);
    }
}
```