1. TRUE / FALSE QUESTIONS

_____You can write any program using only sequence structures.

_____A decision structure can be nested inside another decision structure.

_____A compound Boolean expression created with the `and` operator is true only when both subexpressions are true.

_____The if statement causes one or more statements to execute only when a Boolean expression is true.

_____Nested decision statements are one way to test more than one condition.

_____Python uses the same symbols for the assignment operator as for the equality operator.

_____In flowcharting, the _____ symbol is used to represent a Boolean expression.

_____Python provides a special version of a decision structure known as the _____ statement, which makes the logic of the nested decision structure simpler to write.

_____Boolean variables are commonly used as _____ to indicate whether a specific condition exists.

_____Python allows you to compare strings, but it is not case sensitive.

_____Short -circuit evaluation is only performed with the not operator.

_____Expressions that are tested by the `if` statement are called Boolean expressions.

_____An action in a single alternative decision structure is performed only when the condition is true.

_____Decision structures are also known as selection structures.

_____The following statement will check to see if the turtle's pen color is green:
```
if turtle.pencolor() = 'green'
```

_____The following code snippet will change the background color to green if it is presently red:
```
if turtle.bgcolor() == 'red':
    turtle.bgcolor() = 'green'
```

2. COMPLETION QUESTIONS: Fill in the blanks.

a) The `turtle.isdown()` function returns _____ if the turtle's pen is up.

b) The _____ statement is used to create a single-alternative decision structure.

c) A(n) _____ statement will execute one block of statements if its condition is true or another block if its condition is false.

d) The logical _____ operator reverses the truth of a Boolean expression.

e) A(n) _____ expression is made up of two or more Boolean expressions.

3. ALGORITHM WORKBENCH QUESTIONS

Write assignment statements that perform the following operations

a) Adds 2 to a and assigns the result to b

b) Multiplies b times 4 and assigns the result to a

c) Divides a by 3.14 and assigns the result to b

d) Subtracts 8 from b and assigns the result to a

e) Increases variable c by 1

f) Write an if statement that assigns 20 to the variable y, and assigns 40 to the variable z if the variable x is greater than 100.

g) Write an if-else statement that assigns 0 to the variable b if the variable a is less than 10. Otherwise, it should assign 99 to the variable b.

h) Write nested decision structures that perform the following: compares the amount1 and amount2 then display the greater of amount1 and amount2 to the screen.

MULTIPLE CHOICE QUESTIONS

4. A(n) _____ structure tests a condition and then takes one path if the condition is true, or another path if the condition is false.
a) if statement
b) single alternative decision
c) dual alternative decision
d) sequence

5. A(n) _____ expression has a value of either True or False.
a) binary
b) decision
c) unconditional
d) Boolean

6. Which logical operators perform short-circuit evaluation?
a) or, not
b) not, and
c) or, and
d) and, or, not

7. A (n) _____ structure is a logical design that controls the order in which a set of statements execute.
a) function
b) control
c) sequence
d) iteration

8. Multiple Boolean expressions can be combined by using a logical operator to create _____ expressions.

a) Sequential
b) Logical
c) Compound
d) Mathematical

9. In Python the _____ symbol is used as the equality operator.
a) `==`
b) `<>`
c) `<=`
d) `!=`

10. Which of the following is the correct if clause to determine whether `y` is in the range `10` through `50`, _inclusive_?
a) `if 10 < y or y > 50:`
b) `if 10 > y and y < 50:`
c) `if y >= 10 and y <= 50:`
d) `if y >= 10 or y <= 50:`

11. What is the result of the following Boolean expression, given that `x = 5, y = 3`, and `z = 8`?

```
x < y or z > x
```

a) `True`
b) `False`
c) `8`
d) `5`

12. What is the result of the following Boolean expression, given that `x = 5, y = 3`, and `z= 8`?

```
not (x < y or z > x) and y < z
```

a) `True`
b) `False`
c) `8`
d) `5`

13. Which of the following is the correct if clause to determine whether `choice` is anything other than `10`?
a) `if choice != 10:`
b) `if choice != 10`
c) `if choice <> 10:`
d) `if not(choice < 10 and choice > 10):`

14. When using the _____ logical operator, both subexpressions must be true for the compound expression to be true.

a) `or`

b) `and`

c) `not`

d) `either or or and`

15. Which of the following will hide the turtle if it is visible?

a) `if turtle.isvisible():`
    `turtle.invisible()`

b) `if turtle.isvisible`
    `turtle.hideturtle()`

c) `turtle.isvisible():`
    `turtle.hide()`

d) `if turtle.isvisible():`
    `turtle.hideturtle()`

PROGRAMS

16. The area of a rectangle is the rectangle's length times its width. Write a program that asks for the length and width of two rectangles. The program should tell the user which rectangle has the greater area, or if the areas are the same.

17. The distance a vehicle travels can be calculated as follows:

$$distance = speed \times time$$

For example, if a train travels 40 miles per hour for three hours, the distance traveled is 120 miles.

Write a program that asks the user for the speed of a vehicle (in miles per hour) and the number of hours it has traveled. It should then use a loop to display the distance the vehicle has traveled for each hour of that time period.

An example of the desired output of the program shown below:

```
What is the speed of the vehicle in mph? 40 Enter
How many hours has it traveled? 5 Enter
Hour   Distance-Traveled
1            40.00
2            80.00
3           120.00
4           160.00
5           200.00
```

Note: Do not use this program by using repetition. Next week we will learn the repetitions, so you can write again by using repetition so you can appreciate the existence of repetition structures.

18. Create a change-counting game that gets the user to enter the number of coins required to make exactly one dollar. The program should prompt the user to enter the number of pennies, nickels, dimes, and quarters. *If the total value of the coins entered is equal to one dollar, the program should congratulate the user for winning the game.* Otherwise, the program should display a message indicating whether the amount entered was more than or less than one dollar.

   Note: Remember the following definitions/expressions:
   1penny=1cent, 1nickel=5cents, 1dimes=10cents, 1quarter=25cents, and 1dollar=100cents.

19. The two roots of a quadratic equation, for example, $ax^2 + bx + c = 0$ can be obtained using the following formula:

$$r_1 = \frac{-b+\sqrt{b^2-4ac}}{2a} \quad \text{and } r_2 = \frac{-b-\sqrt{b^2-4ac}}{2a}$$

$b^2 - 4ac$ is called the discriminant of the quadratic equation. If it is positive, the equation has two real roots. If it is zero, the equation has one root. If it is negative, the equation has no real roots.

Write a program that prompts the user to enter values for *a*, *b*, and *c* and displays the result based on the discriminant. If the discriminant is positive, display two roots. If the discriminant is 0, display one root. Otherwise, display the equation has no real roots. Here are some sample runs.

```
Enter a, b, c: 1.0, 3, 1  ↵Enter
The roots are -0.381966 and -2.61803
```

```
Enter a, b, c: 1, 2.0, 1  ↵Enter
The root is -1
```

```
Enter a, b, c: 1, 2, 3  ↵Enter
The equation has no real roots
```

20. One can use Cramer's rule to solve the following 2x2 Linear equation system:

$$\begin{array}{l} ax + by = e \\ cx + dy = f \end{array} \quad x = \frac{ed - bf}{ad - bc} \quad y = \frac{af - ec}{ad - bc}$$

Write a program that prompts the user to enter **a**, **b**, **c**, **d**, **e**, and **f** and display the result. If $ad - bc$ is **0**, report that **The equation has no solution**.
Here are some sample runs.

```
Enter a, b, c, d, e, f: 9.0, 4.0, 3.0, -5.0, -6.0, -21.0  ↵Enter
x is -2.0 and y is 3.0
```

```
Enter a, b, c, d, e, f: 1.0, 2.0, 2.0, 4.0, 4.0, 5.0  ↵Enter
The equation has no solution
```

21. *(Geometry: point in a circle?)* Write a program that prompts the user to enter a point (x, y) and checks whether the point is within the circle centered at (0, 0) with radius 10. For example, (4, 5) is inside the circle and (9, 9) is outside the circle, as shown in Figure

(a)   (b)
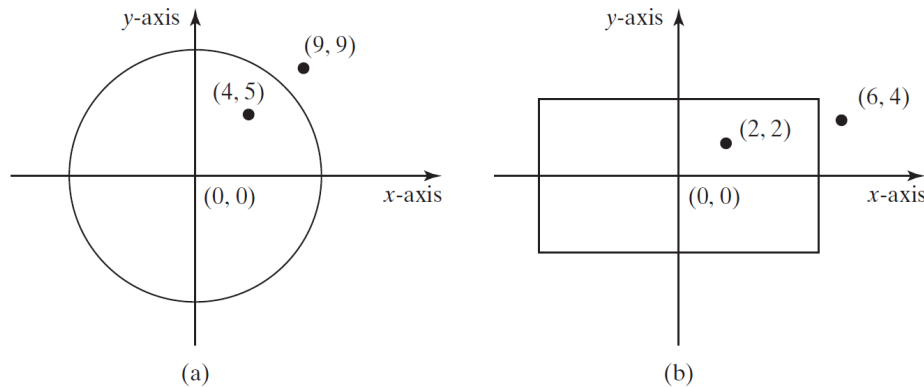
FIGURE (a) Points inside and outside of the circle; (b) points inside and outside of the rectangle.

(Hint: A point is in the circle if its distance to (**0, 0**) is less than or equal to **10**. The formula for computing the distance is $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$. Test your program to cover all cases.) Two sample runs are shown next.

```
Enter a point with two coordinates: 4, 5   ↵ Enter
Point (4.0, 5.0) is in the circle
```

```
Enter a point with two coordinates: 9, 9   ↵ Enter
Point (9.0, 9.0) is not in the circle
```

22. *(Geometry: point in a rectangle?)* Write a program that prompts the user to enter a point (x, y) and checks whether the point is within the rectangle centered at (0, 0) with width 10 and height 5. For example, (2, 2) is inside the rectangle and (6, 4) is outside the rectangle, as shown in Figure b from previous problem (problem 21).

(Hint: A point is in the rectangle if its horizontal distance to (0, 0) is less than or equal to 10 / 2 and its vertical distance to (0, 0) is less than or equal to 5.0 / 2. Test your program to cover all cases.)

Here are two sample runs:

```
Enter a point with two coordinates: 2, 2   ↵ Enter
Point (2.0, 2.0) is in the rectangle
```

```
Enter a point with two coordinates: 6, 4   ↵ Enter
Point (6.0, 4.0) is not in the rectangle
```

23. Write a program that prompts the user to enter the month and year and displays the number of days in the month. For example, if the user entered month 2 and year 2000, the program should display that February 2000 has 29 days. If the user entered month 3 and year 2005, the program should display that March 2005 has 31 days.

24. Write a program that prompts the user to enter an integer for today's day of the week (Sunday is 0, Monday is 1, ..., and Saturday is 6). Also prompt the user to enter the number of days after today for a future day and display the future day of the week.
Here is a sample run:

```
Enter today's day: 1  [↵ Enter]
Enter the number of days elapsed since today: 3  [↵ Enter]
Today is Monday and the future day is Thursday
```

25. Write a program that prompts the user to enter three integers and displays them in increasing order (*Do not use lists or other structures, do this by using three variables and decision structures that we have learned in Chap 3*).

26. A Write a program that calculates the grade of a student. The program first inputs the midterm and the final exam results of the student from the keyboard (exam results are out of 100). Then also inputs the percentages of the Midterm and Final Exams. Then it calculates the grade of the student by using the given exam results and the percentages. At the end of the program writes the grade and the corresponding letter grade of the student to screen according to the following table. Also your program should writes if the student have passed (>=50) or failed (<50).

Grade Range	Letter Grade
$0 \leq$ Grade < 50	F
$50 \leq$ Grade < 60	D
$60 \leq$ Grade < 70	C
$70 \leq$ Grade < 85	B
$85 \leq$ Grade	A

An example terminal output of the program as below:

Enter Midterm and Final Exam Grades: 40 70
Enter Midterm and Final Exam Percentages: 30 70
Your grade is 61
Your letter grade is C
You have PASSED.

27. Serendipity Booksellers has a book club that awards points to its customers based on the number of books purchased each month. The points are awarded as follows:
• If a customer purchases 0 books, he or she earns 0 points.
• If a customer purchases 2 books, he or she earns 5 points.
• If a customer purchases 4 books, he or she earns 15 points.
• If a customer purchases 6 books, he or she earns 30 points.
• If a customer purchases 8 or more books, he or she earns 60 points.
Write a program that asks the user to enter the number of books that he or she has purchased this month, then displays the number of points awarded.