

## AP Principles 3.1, 3.2, 3.3, 3.4, 3.5 MCQ

1. A code segment will be used to swap the values of the variables  $a$  and  $b$  using the temporary variable  $temp$ .

Which of the following code segments correctly swaps the values of  $a$  and  $b$ ?

(A)  $a \leftarrow b$   
 $temp \leftarrow a$   
 $b \leftarrow temp$

(B)  $temp \leftarrow a$   
 $a \leftarrow b$   
 $b \leftarrow temp$

(C)  $temp \leftarrow a$   
 $a \leftarrow temp$   
 $a \leftarrow b$

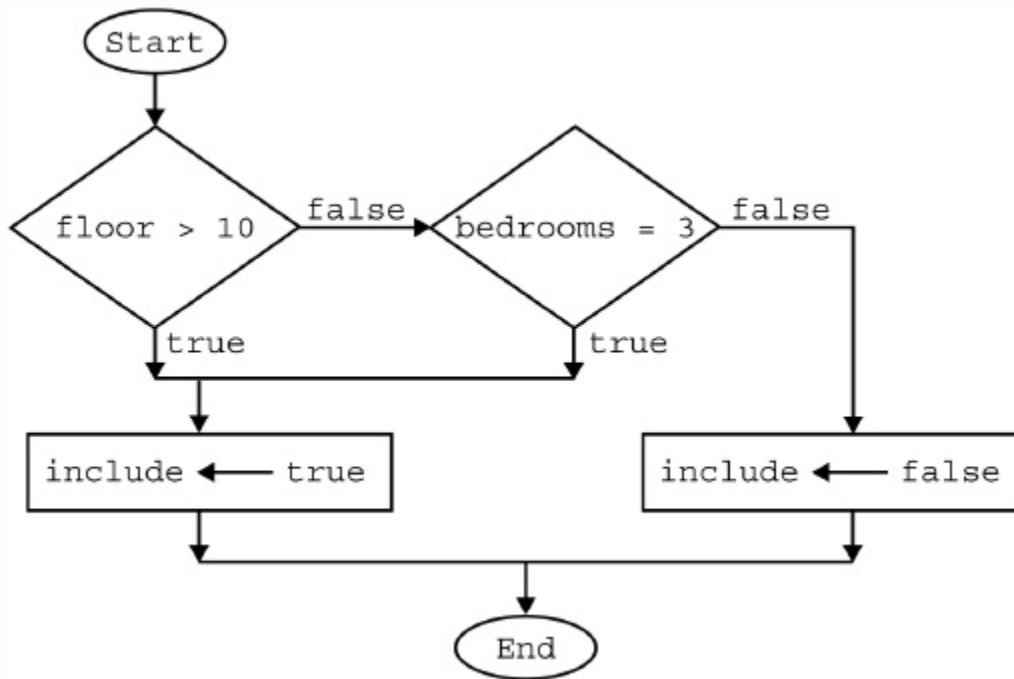
(D)  $temp \leftarrow a$   
 $b \leftarrow temp$   
 $a \leftarrow b$

AP Principles 3.1, 3.2, 3.3, 3.4, 3.5 MCQ

2. **Directions:** The question or incomplete statement below is followed by four suggested answers or completions. Select the one that is best in each case.

A flowchart is a way to visually represent an algorithm. The flowchart below is used by an apartment rental Web site to set the variable `include` to `true` for apartments that meet certain criteria.

Block	Explanation
Oval ○	The start or end of the algorithm
Diamond ◇	A conditional or decision step, where execution proceeds to the side labeled <code>true</code> if the condition is true and to the side labeled <code>false</code> otherwise
Rectangle □	One or more processing steps, such as a statement that assigns a value to a variable



Which of the following statements is equivalent to the algorithm in the flowchart?

**AP Principles 3.1, 3.2, 3.3, 3.4, 3.5 MCQ**

- (A) `include ← (floor > 10) OR (bedrooms = 3)`
- (B) `include ← (floor > 10) AND (bedrooms = 3)`
- (C) `include ← (floor ≤ 10) OR (bedrooms = 3)`
- (D) `include ← (floor ≤ 10) AND (bedrooms = 3)`
3. A student is creating an algorithm to display the distance between the numbers `num1` and `num2` on a number line. The following table shows the distance for several different values.

Value of <code>num1</code>	Value of <code>num2</code>	Distance Between <code>num1</code> and <code>num2</code>
5	2	3
1	8	7
-3	4	7

Which of the following algorithms displays the correct distance for all possible values of `num1` and `num2` ?

**AP Principles 3.1, 3.2, 3.3, 3.4, 3.5 MCQ**

- (A) Step 1: Add `num1` and `num2` and store the result in the variable `sum`.  
Step 2: Take the absolute value of `sum` and display the result.

- (B) Step 1: Subtract `num1` from `num2` and store the result in the variable `diff`.  
Step 2: Take the absolute value of `diff` and display the result.

- (C) Step 1: Take the absolute value of `num1` and store it in the variable `absNum1`.  
Step 2: Take the absolute value of `num2` and store it in the variable `absNum2`.  
Step 3: Add `absNum1` and `absNum2` and display the result.

- (D) Step 1: Take the absolute value of `num1` and store it in the variable `absNum1`.  
Step 2: Take the absolute value of `num2` and store it in the variable `absNum2`.  
Step 3: Subtract `absNum1` from `absNum2` and display the result.

4. A teacher has a goal of displaying the names of 2 students selected at random from a group of 30 students in a classroom. Any possible pair of students should be equally likely to be selected. Which of the following algorithms can be used to accomplish the teacher's goal?

**AP Principles 3.1, 3.2, 3.3, 3.4, 3.5 MCQ**

- (A) Step 1:  
Assign each student a unique integer from 1 to 30.
- Step 2:  
Generate a random integer  $n$  from 1 to 15.
- Step 3:  
Select the student who is currently assigned integer  $n$  and display the student's name.
- Step 4:  
Generate a new random integer  $n$  from 16 to 30.
- Step 5:  
Select the student who is currently assigned integer  $n$  and display the student's name.

- (B) Step 1:  
Assign each student a unique integer from 1 to 30.
- Step 2:  
Generate a random integer  $n$  from 1 to 30.
- Step 3:  
Select the student who is currently assigned integer  $n$  and display the student's name.
- Step 4:  
Generate a new random integer  $n$  from 1 to 30.
- Step 5:  
Select the student who is currently assigned integer  $n$  and display the student's name.

- (C) Step 1:  
Assign each student a unique integer from 1 to 30.
- Step 2:  
Generate a random odd integer  $n$  from 1 to 29.
- Step 3:  
Select the student who is currently assigned integer  $n$  and display the student's name.
- Step 4:  
Generate a new random even integer  $n$  from 2 to 30.
- Step 5:  
Select the student who is currently assigned integer  $n$  and display the student's name.

- (D) Step 1:  
Assign each student a unique integer from 1 to 30.

## AP Principles 3.1, 3.2, 3.3, 3.4, 3.5 MCQ

- Step 2:  
Generate a random integer  $n$  from 1 to 30.
- Step 3:  
Select the student who is currently assigned integer  $n$  and display the student's name.
- Step 4:  
The student who was selected in the previous step is assigned 0. All other students are reassigned a unique integer from 1 to 29.
- Step 5:  
Generate a new random integer  $n$  from 1 to 29.
- Step 6:  
Select the student who is currently assigned integer  $n$  and display the student's name.

5. **Directions:** The question or incomplete statement below is followed by four suggested answers or completions. Select the one that is best in each case.

A **NAND** gate is a type of logic gate that produces an output of **false** only when both of its two inputs are **true**. Otherwise, the gate produces an output of **true**. Which of the following Boolean expressions correctly models a **NAND** gate with inputs **P** and **Q** ?

- (A) **(NOT P) AND (NOT Q)**
- (B) **(NOT P) AND Q**
- (C) **NOT (P AND Q)**
- (D) **NOT (P OR Q)**
6. An office building has two floors. A computer program is used to control an elevator that travels between the two floors. Physical sensors are used to set the following Boolean variables.

Variable	Description
<code>onFloor1</code>	set to <b>true</b> if the elevator is stopped on floor 1; otherwise set to <b>false</b>
<code>onFloor2</code>	set to <b>true</b> if the elevator is stopped on floor 2; otherwise set to <b>false</b>
<code>callTo1</code>	set to <b>true</b> if the elevator is called to floor 1; otherwise set to <b>false</b>
<code>callTo2</code>	set to <b>true</b> if the elevator is called to floor 2; otherwise set to <b>false</b>

The elevator moves when the door is closed and the elevator is called to the floor that it is not currently on. Which of the following Boolean expressions can be used in a selection statement to cause the elevator to move?

**AP Principles 3.1, 3.2, 3.3, 3.4, 3.5 MCQ**

- (A)  $(onFloor1 \text{ AND } callTo2) \text{ AND } (onFloor2 \text{ AND } callTo1)$
  - (B)  $(onFloor1 \text{ AND } callTo2) \text{ OR } (onFloor2 \text{ AND } callTo1)$
  - (C)  $(onFloor1 \text{ OR } callTo2) \text{ AND } (onFloor2 \text{ OR } callTo1)$
  - (D)  $(onFloor1 \text{ OR } callTo2) \text{ OR } (onFloor2 \text{ OR } callTo1)$
7. The variable `age` is to be used to represent a person's age, in years. Which of the following is the most appropriate data type for `age`?
- (A) Boolean
  - (B) number
  - (C) string
  - (D) list
8. The variable `isOpen` is to be used to indicate whether or not a store is currently open. Which of the following is the most appropriate data type for `isOpen`?
- (A) Boolean
  - (B) number
  - (C) string
  - (D) list
9. A teacher is writing a code segment that will use variables to represent a student's name and whether or not the student is currently absent. Which of the following variables are most appropriate for the code segment?
- (A) A string variable named `s` and a Boolean variable named `a`
  - (B) A string variable named `s` and a numeric variable named `n`
  - (C) A string variable named `studentName` and a Boolean variable named `isAbsent`
  - (D) A string variable named `studentName` and a numeric variable named `numAbsences`
10. A programmer completes the user manual for a video game she has developed and realizes she has reversed the roles of goats and sheep throughout the text. Consider the programmer's goal of changing all occurrences of "goats" to "sheep" and all occurrences of "sheep" to "goats." The programmer will use the fact that the word "foxes" does not appear anywhere in the original text.
- Which of the following algorithms can be used to accomplish the programmer's goal?
- (A) First, change all occurrences of "goats" to "sheep."  
Then, change all occurrences of "sheep" to "goats."
  - (B) First, change all occurrences of "goats" to "sheep."  
Then, change all occurrences of "sheep" to "goats."  
Last, change all occurrences of "foxes" to "sheep."
  - (C) First, change all occurrences of "goats" to "foxes."  
Then, change all occurrences of "sheep" to "goats."  
Last, change all occurrences of "foxes" to "sheep."
  - (D) First, change all occurrences of "goats" to "foxes."  
Then, change all occurrences of "foxes" to "sheep."  
Last, change all occurrences of "sheep" to "goats."

## AP Principles 3.1, 3.2, 3.3, 3.4, 3.5 MCQ

11. **Directions:** For the question or incomplete statement below, two of the suggested answers are correct. For this question, you must select both correct choices to earn credit. No partial credit will be earned if only one correct choice is selected. Select the two that are best in each case.

A school library allows students to borrow laptops. A computer program is used to count the number of times a particular laptop has been borrowed from the library (`borrow`s) and the number of times the same laptop has been returned to the library (`return`s). Which of the following indicate that a particular laptop is not currently borrowed?

Select two answers.

- A The difference between `borrow`s and `return`s is zero.
  - B The product of `borrow`s and `return`s is a positive even number.
  - C The quotient when `borrow`s is divided by `return`s is greater than 1.
  - D The sum of `borrow`s and `return`s is a positive even number.
12. **Directions:** The question or incomplete statement below is followed by four suggested answers or completions. Select the one that is best in each case.

A snack bar has a frequent customer program in which every 10th purchase is free. Customers are enrolled in the program when they make their first purchase. A programmer is writing a program to implement the frequent customer program. In one code segment, `cost` is set to 0 for every 10th purchase by a given customer. The programmer will use the procedure `GetCount (customerID)`, which returns the total number of purchases a customer has made since enrolling in the frequent customer program, including his or her first purchase.

Which of the following code segments will set `cost` to 0 for every 10th purchase a customer makes after enrolling in the frequent customer program?



## AP Principles 3.1, 3.2, 3.3, 3.4, 3.5 MCQ

- ```
count ← GetCount (customerID)
IF (count / 10 = 0)
(A) {
    cost ← 0
}
count ← GetCount (customerID)
IF (NOT (count / 10 = 0))
(B) {
    cost ← 0
}
count ← GetCount (customerID)
IF (count MOD 10 = 0)
(C) {
    cost ← 0
}
count ← GetCount (customerID)
IF (NOT (count MOD 10 = 0))
(D) {
    cost ← 0
}
```

13. Consider the following code segment, which uses the variables r, s, and t.

```
r ← 1
```

```
s ← 2
```

```
t ← 3
```

```
r ← s
```

```
s ← t
```

```
DISPLAY (r)
```

```
DISPLAY (s)
```

What is displayed as a result of running the code segment?

- (A) 1 1
- (B) 1 2
- (C) 2 3
- (D) 3 2

## AP Principles 3.1, 3.2, 3.3, 3.4, 3.5 MCQ

14. **Directions:** The question or incomplete statement below is followed by four suggested answers or completions. Select the one that is best in each case.

Consider the following program, which uses the variables `start`, `end`, and `current`.

```
start ← 1
end ← 20
current ← 3
start ← current
current ← current + 1
DISPLAY (start)
DISPLAY (current)
```

What is displayed as a result of executing the program?

- (A) 1 3
  - (B) 3 3
  - (C) 3 4
  - (D) 4 4
15. **Directions:** The question or incomplete statement below is followed by four suggested answers or completions. Select the one that is best in each case.

A student is writing a program to model different real-world events using simulations. Which of the following simulations will generate a result that would best be stored using a Boolean variable?

- (A) A simulation of flipping a fair coin
  - (B) A simulation of rolling a fair die (with sides numbered 1 through 6)
  - (C) A simulation of the temperature in a location over time
  - (D) A simulation of traffic patterns on a road
16. Which of the following is a benefit of using a list as a data abstraction in a program?
- (A) Lists often allow their size to be easily updated to hold as many data values as needed.
  - (B) Lists convert all elements to strings so that they can be inspected character-by-character.
  - (C) Lists prevent duplicate data values from appearing in the list.
  - (D) Lists are used to store all input data so that there is a running record of all user input.
17. A programmer has a need to round many numeric values to the nearest integer. Which of the following best explains the benefit of using a list as a data abstraction in this situation?

### AP Principles 3.1, 3.2, 3.3, 3.4, 3.5 MCQ

- (A) Keeping the numeric values in a list makes it easier to round a number to the nearest integer.
- (B) Keeping the numeric values in a list makes it easier to apply the same computation to every data element.
- (C) Keeping the numeric values in a list makes it easier to prevent a program from unintentionally changing the value of a variable.
- (D) Keeping the numeric values in a list makes it easier to prevent a program from attempting to access an index beyond the length of the list.

18. **Directions: For the question or incomplete statement below, two of the suggested answers are correct. For this question, you must select both correct choices to earn credit. No partial credit will be earned if only one correct choice is selected. Select the two that are best in each case.**

Which of the following are benefits of using well-named variables in a computer program?

Select two answers.

- A The program will run faster.
- B The program will be easier for people to read.
- C The program will have a greater data storage capacity.
- D The program will be easier to modify in the future.

19. The following table shows the value of `expression` based on the values of `input1` and `input2`.

| Value of <code>input1</code> | Value of <code>input2</code> | Value of <code>expression</code> |
|------------------------------|------------------------------|----------------------------------|
| true                         | true                         | false                            |
| true                         | false                        | true                             |
| false                        | true                         | true                             |
| false                        | false                        | true                             |

Which of the following expressions are equivalent to the value of `expression` as shown in the table?

Select two answers.

- A `(NOT input1) OR (NOT input2)`
- B `(NOT input1) AND (NOT input2)`
- C `NOT (input1 OR input2)`
- D `NOT (input1 AND input2)`

## AP Principles 3.1, 3.2, 3.3, 3.4, 3.5 MCQ

20. **Directions:** For the question or incomplete statement below, two of the suggested answers are correct. For this question, you must select both correct choices to earn credit. No partial credit will be earned if only one correct choice is selected. Select the two that are best in each case.

Which of the following Boolean expressions are equivalent to the expression

`num ≥ 15`?

Select two answers.

- A `(num > 15) AND (num = 15)`
- B `(num > 15) OR (num = 15)`
- C `NOT (num < 15)`
- D `NOT (num < 16)`

21. A program contains the following procedures for string manipulation.

| Procedure Call                              | Explanation                                                                                                                                                                                                                                                                                                              |
|---------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>Concat (str1, str2)</code>            | Returns a single string consisting of <code>str1</code> followed by <code>str2</code> . For example, <code>Concat ("key", "board")</code> returns "keyboard".                                                                                                                                                            |
| <code>Substring (str, start, length)</code> | Returns a substring of consecutive characters from <code>str</code> , starting with the character at position <code>start</code> and containing <code>length</code> characters. The first character of <code>str</code> is located at position 1. For example, <code>Substring ("delivery", 3, 4)</code> returns "live". |

Which of the following can be used to store the string "jackalope" in the string variable `animal`?

Select two answers.

- A `animal ← Substring ("antelope", 5, 4)`  
`animal ← Concat (animal, "a")`  
`animal ← Concat (Substring ("jackrabbit", 1, 4), animal)`
- B `animal ← Substring ("antelope", 5, 4)`  
`animal ← Concat ("a", animal)`  
`animal ← Concat (Substring ("jackrabbit", 1, 4), animal)`
- C `animal ← Substring ("jackrabbit", 1, 4)`  
`animal ← Concat (animal, "a")`  
`animal ← Concat (animal, Substring ("antelope", 5, 4))`
- D `animal ← Substring ("jackrabbit", 1, 4)`  
`animal ← Concat (animal, "a")`  
`animal ← Concat (Substring ("antelope", 5, 4), animal)`

## AP Principles 3.1, 3.2, 3.3, 3.4, 3.5 MCQ

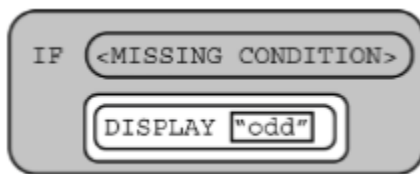
22. Assume that both lists and strings are indexed starting with index 1.

The list `wordList` has the following contents.

```
["abc", "def\", "ghi", "jkl"]
```

Let `myWord` be the element at index 3 of `wordList`. Let `myChar` be the character at index 2 of `myWord`. What is the value of `myChar`?

- (A) "e"
  - (B) "f\"
  - (C) "h"
  - (D) "i"
23. The code fragment below is intended to display "odd" if the positive number *num* is odd.

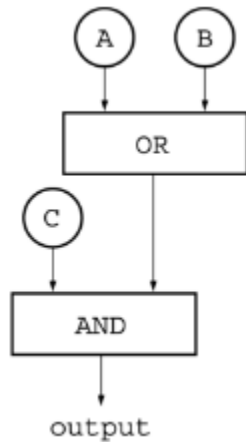


Which of the following can be used to replace `<MISSING CONDITION>` so that the code fragment will work as intended?

- (A)  $(\text{num MOD } 1) = 0$
- (B)  $(\text{num MOD } 1) = 1$
- (C)  $(\text{num MOD } 2) = 0$
- (D)  $(\text{num MOD } 2) = 1$

## AP Principles 3.1, 3.2, 3.3, 3.4, 3.5 MCQ

24. The diagram below shows a circuit composed of two logic gates labeled *OR* and *AND*. Each gate takes two inputs and produces a single output.



If the inputs *A* and *C* are both *true*, which of the following best describes the output of the *AND* gate?

- (A) The output will be *true* no matter what the value of input *B* is.
  - (B) The output will be *false* no matter what the value of input *B* is.
  - (C) The output will be *true* if input *B* is *true*; otherwise it will be *false*.
  - (D) The output will be *false* if input *B* is *true*; otherwise it will be *true*.
25. Consider the following code segment.

```
yourList ← [20, 40, 60, 80]
myList ← [10, 30, 50, 70]
yourList ← myList
```

What are the contents of `yourList` after the code segment is executed?

- (A) [10, 30, 50, 70]
- (B) [20, 40, 60, 80]
- (C) [10, 30, 50, 70, 20, 40, 60, 80]
- (D) [20, 40, 60, 80, 10, 30, 50, 70]

## AP Principles 3.1, 3.2, 3.3, 3.4, 3.5 MCQ

26. A list of numbers has  $n$  elements, indexed from 1 to  $n$ . The following algorithm is intended to display the number of elements in the list that have a value greater than 100. The algorithm uses the variables `count` and `position`. Steps 3 and 4 are missing.

Step 1 Set `count` to 0 and `position` to 1.

Step 2 If the value of the element at index `position` is greater than 100, increase the value of `count` by 1.

Step 3 (missing step)

Step 4 (missing step)

Step 5 Display the value of `count`.

Which of the following could be used to replace steps 3 and 4 so that the algorithm works as intended?

- (A) Step 3  
Increase the value of `position` by 1.  
Step 4  
Repeat steps 2 and 3 until the value of `count` is greater than 100.
- (B) Step 3  
Increase the value of `position` by 1.  
Step 4  
Repeat steps 2 and 3 until the value of `position` is greater than  $n$ .
- (C) Step 3  
Repeat step 2 until the value of `count` is greater than 100.  
Step 4  
Increase the value of `position` by 1.
- (D) Step 3  
Repeat step 2 until the value of `position` is greater than  $n$ .  
Step 4  
Increase the value of `count` by 1.

**AP Principles 3.1, 3.2, 3.3, 3.4, 3.5 MCQ**

27. A programmer wants to determine whether a score is within 10 points of a given target. For example, if the target is 50, then the scores 40, 44, 50, 58, and 60 are all within 10 points of the target, while 38 and 61 are not.

Which of the following Boolean expressions will evaluate to `true` if and only if `score` is within 10 points of `target`?

- (A)  $(\text{score} \leq \text{target} + 10) \text{ AND } (\text{target} + 10 \leq \text{score})$   
(B)  $(\text{target} + 10 \leq \text{score}) \text{ AND } (\text{score} \leq \text{target} - 10)$   
(C)  $(\text{score} \leq \text{target} - 10) \text{ AND } (\text{score} \leq \text{target} + 10)$   
(D)  $(\text{target} - 10 \leq \text{score}) \text{ AND } (\text{score} \leq \text{target} + 10)$
28. A list of numbers has `n` elements, indexed from 1 to `n`. The following algorithm is intended to display `true` if the value `target` appears in the list more than once and to display `false` otherwise. The algorithm uses the variables `position` and `count`. Steps 4 and 5 are missing.

Step 1 Set `count` to 0 and `position` to 1.

Step 2 If the value of the element at index `position` is equal to `target`, increase the value of `count` by 1.

Step 3 Increase the value of `position` by 1.

Step 4 (missing step)

Step 5 (missing step)

Which of the following could be used to replace steps 4 and 5 so that the algorithm works as intended?



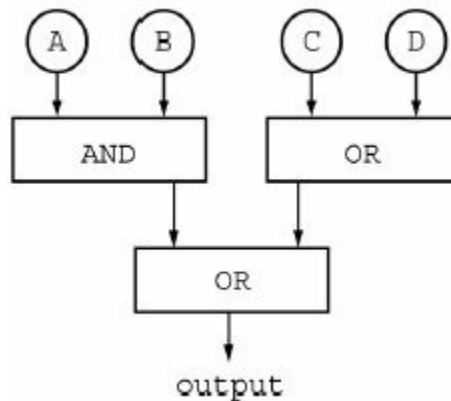
## AP Principles 3.1, 3.2, 3.3, 3.4, 3.5 MCQ

- (A) Step 4 Repeat steps 2 and 3 until the value of `position` is greater than `n`.  
Step 5 If `count` is greater than or equal to `2`, display `true`. Otherwise, display `false`.
- (B) Step 4 Repeat steps 2 and 3 until the value of `position` is greater than `n`.  
Step 5 If `count` is greater than or equal to `position`, display `true`. Otherwise, display `false`.
- (C) Step 4 Repeat steps 2 and 3 until the value of `count` is greater than `2`.  
Step 5 If `position` is greater than or equal to `n`, display `true`. Otherwise, display `false`.
- (D) Step 4 Repeat steps 2 and 3 until the value of `count` is greater than `n`.  
Step 5 If `count` is greater than or equal to `2`, display `true`. Otherwise, display `false`.

## AP Principles 3.1, 3.2, 3.3, 3.4, 3.5 MCQ

29. **Directions:** The question or incomplete statement below is followed by four suggested answers or completions. Select the one that is best in each case.

The diagram below shows a circuit composed of three logic gates. Each gate takes two inputs and produces a single output.



For which of the following input values will the circuit have an output of `false` ?

- (A) `A = true, B = false, C = false, D = false`  
 (B) `A = true, B = true, C = false, D = false`  
 (C) `A = false, B = false, C = true, D = true`  
 (D) `A = false, B = false, C = false, D = true`
30. The following code segment is used to determine whether a customer is eligible for a discount on a movie ticket.

```

val1 ← (NOT (category = "new")) OR (age ≥ 65)
val2 ← (category = "new") AND (age < 12)
  
```

If `category` is `"new"` and `age` is 20, what are the values of `val1` and `val2` as a result of executing the code segment?

- (A) `val1 = true, val2 = true`  
 (B) `val1 = true, val2 = false`  
 (C) `val1 = false, val2 = true`  
 (D) `val1 = false, val2 = false`
31. To be eligible for a particular ride at an amusement park, a person must be at least 12 years old and must be between 50 and 80 inches tall, inclusive.

Let `age` represent a person's age, in years, and let `height` represent the person's height, in inches. Which of the following expressions evaluates to `true` if and only if the person is eligible for the ride?

### AP Principles 3.1, 3.2, 3.3, 3.4, 3.5 MCQ

- (A)  $(\text{age} \geq 12) \text{ AND } ((\text{height} \geq 50) \text{ AND } (\text{height} \leq 80))$
- (B)  $(\text{age} \geq 12) \text{ AND } ((\text{height} \leq 50) \text{ AND } (\text{height} \geq 80))$
- (C)  $(\text{age} \geq 12) \text{ AND } ((\text{height} \leq 50) \text{ OR } (\text{height} \geq 80))$
- (D)  $(\text{age} \geq 12) \text{ OR } ((\text{height} \geq 50) \text{ AND } (\text{height} \leq 80))$
32. To attend a particular camp, a student must be either at least 13 years old or in grade 9 or higher, but must not yet be 18 years old. Let `age` represent a student's age and let `grade` represent the student's grade level. Which of the following expressions evaluates to `true` if the student is eligible to attend the camp and evaluates to `false` otherwise?
- (A)  $((\text{age} \geq 13) \text{ OR } (\text{grade} \geq 9)) \text{ AND } (\text{age} \leq 18)$
- (B)  $((\text{age} \geq 13) \text{ OR } (\text{grade} \geq 9)) \text{ AND } (\text{age} < 18)$
- (C)  $((\text{age} \geq 13) \text{ OR } (\text{grade} \geq 9)) \text{ OR } (\text{age} \leq 18)$
- (D)  $((\text{age} \geq 13) \text{ OR } (\text{grade} \geq 9)) \text{ OR } (\text{age} < 18)$
33. Let  $n$  be an integer value. Which of the following expressions evaluates to `true` if and only if  $n$  is a two-digit integer (i.e., in the range from 10 to 99, inclusive)?
- (A)  $n = (n \text{ MOD } 100)$
- (B)  $(n \geq 10) \text{ AND } (n < 100)$
- (C)  $(n < 10) \text{ AND } (n \geq 100)$
- (D)  $(n > 10) \text{ AND } (n < 99)$

A large spreadsheet contains the following information about local restaurants. A sample portion of the spreadsheet is shown below.

|   | <b>A</b><br>Restaurant Name | <b>B</b><br>Price Range | <b>C</b><br>Number of<br>Customer Ratings | <b>D</b><br>Average<br>Customer Rating | <b>E</b><br>Accepts<br>Credit Cards |
|---|-----------------------------|-------------------------|-------------------------------------------|----------------------------------------|-------------------------------------|
| 1 | Joey Calzone's Pizzeria     | lo                      | 182                                       | 3.5                                    | false                               |
| 2 | 78th Street Bistro          | med                     | 41                                        | 4.5                                    | false                               |
| 3 | Seaside Taqueria            | med                     | 214                                       | 4.5                                    | true                                |
| 4 | Delicious Sub Shop II       | lo                      | 202                                       | 4.0                                    | false                               |
| 5 | Rustic Farm Tavern          | hi                      | 116                                       | 4.5                                    | true                                |
| 6 | ABC Downtown Diner          | med                     | 0                                         | -1.0                                   | true                                |

In column B, the price range represents the typical cost of a meal, where "lo" indicates under \$10, "med" indicates \$11 to \$30, and "hi" indicates over \$30.

In column D, the average customer rating is set to `-1.0` for restaurants that have no customer ratings.

**AP Principles 3.1, 3.2, 3.3, 3.4, 3.5 MCQ**

34. A student wants to count the number of restaurants in the spreadsheet whose price range is \$30 or less and whose average customer rating is at least 4.0. For a given row in the spreadsheet, suppose `prcRange` contains the price range as a string and `avgRating` contains the average customer rating as a decimal number.

Which of the following expressions will evaluate to `true` if the restaurant should be counted and evaluates to `false` otherwise?

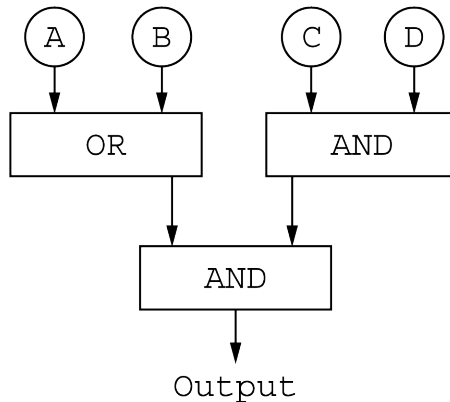
- (A) `(avgRating ≥ 4.0) AND ((prcRange = "lo") AND (prcRange = "med"))`
  - (B) `(avgRating ≥ 4.0) AND ((prcRange = "lo") OR (prcRange = "med"))`
  - (C) `(avgRating ≥ 4.0) OR ((prcRange = "lo") AND (prcRange = "med"))`
  - (D) `(avgRating ≥ 4.0) OR ((prcRange = "lo") OR (prcRange = "med"))`
- 
35. To qualify for a particular scholarship, a student must have an overall grade point average of 3.0 or above and must have a science grade point average of over 3.2. Let `overallGPA` represent a student's overall grade point average and let `scienceGPA` represent the student's science grade point average. Which of the following expressions evaluates to `true` if the student is eligible for the scholarship and evaluates to `false` otherwise?
- (A) `(overallGPA > 3.0) AND (scienceGPA > 3.2)`
  - (B) `(overallGPA > 3.0) AND (scienceGPA ≥ 3.2)`
  - (C) `(overallGPA ≥ 3.0) AND (scienceGPA > 3.2)`
  - (D) `(overallGPA ≥ 3.0) AND (scienceGPA ≥ 3.2)`
36. Assume that the Boolean variable `hot` is assigned the value `true` and the Boolean variable `humid` is assigned the value `false`. Which of the following will display the value `true`?

Select two answers.

AP Principles 3.1, 3.2, 3.3, 3.4, 3.5 MCQ

- A IF hot  
DISPLAY hot AND humid
- B IF NOT humid  
DISPLAY hot OR humid
- C IF hot OR humid  
DISPLAY hot
- D IF hot AND humid  
DISPLAY hot

37. The diagram below shows a circuit composed of three logic gates. Each gate takes two inputs and produces a single output.



For which of the following input values will the circuit have an output of true ?

- (A) A = true, B = true, C = true, D = false
- (B) A = true, B = false, C = false, D = true
- (C) A = false, B = true, C = true, D = true
- (D) A = false, B = false, C = true, D = true

## AP Principles 3.1, 3.2, 3.3, 3.4, 3.5 MCQ

38. Consider the following code segment.

```
integerList ← 4, 2, 5, 4, 2, 3, 1
result ← 0
FOR EACH item IN integerList
    result ← result + (item MOD 2)
DISPLAY result
```

What value is displayed as a result of executing the code segment?

- (A) 3  
 (B) 4  
 (C) 9  
 (D) 12
39. A game is played by moving a game piece left or right along a horizontal game board. The board consists of spaces of various colors, as shown. The circle represents the initial location of the game piece.

|        |       |       |       |     |        |       |       |        |       |
|--------|-------|-------|-------|-----|--------|-------|-------|--------|-------|
| Yellow | Black | Green | Green | Red | Yellow | Black | Black | Yellow | Black |
|        |       |       |       |     |        |       |       |        | ●     |

The following algorithm indicates how the game is played. The game continues until the game is either won by landing on the red space or lost when the piece moves off either end of the board.

- Step 1 Place a game piece on a space that is not red and set a counter to 0.
- Step 2 If the game piece is on a yellow space, move the game piece 3 positions to the left and go to step 3. Otherwise, if the game piece is on a black space, move the game piece 1 position to the left and go to step 3. Otherwise, if the game piece is on a green space, move the game piece 2 positions to the right and go to step 3.
- Step 3 Increase the value of the counter by 1.
- Step 4 If game piece is on the red space or moved off the end of the game board, the game is complete. Otherwise, go back to step 2.

If a game is begun by placing the game piece on the rightmost black space for step 1, what will be the value of the counter at the end of the game?

**AP Principles 3.1, 3.2, 3.3, 3.4, 3.5 MCQ**

- (A) 2
- (B) 3
- (C) 4
- (D) 5

40. Consider the following code segment.

```
firstList ← ["guitar", "drums", "bass"]
secondList ← ["flute", "violin"]
thirdList ← []
thirdList ← firstList
firstList ← secondList
secondList ← thirdList
```

What are the contents of `secondList` after the code segment is executed?

- (A) []
  - (B) ["guitar", "drums", "bass"]
  - (C) ["flute", "violin"]
  - (D) ["flute", "violin", "guitar", "drums", "bass"]
41. In a certain country, a person must be at least 16 years old to drive a car and must be at least 18 years old to vote. The variable `age` represents the age of a person as an integer.

Which of the following expressions evaluates to `true` if the person is old enough to drive but not old enough to vote, and evaluates to `false` otherwise?

- I.  $(age \geq 16) \text{ AND } (age \leq 18)$
  - II.  $(age \geq 16) \text{ AND } (\text{NOT}(age \geq 18))$
  - III.  $(age < 18) \text{ AND } (\text{NOT}(age < 16))$
- (A) II only
  - (B) I and II only
  - (C) I and III only
  - (D) II and III only

## AP Principles 3.1, 3.2, 3.3, 3.4, 3.5 MCQ

42. The following algorithm is intended to take a positive integer as input and display its individual digits in order from right to left. For example, if the input is 512, the algorithm should produce the output 2 1 5. Step 3 of the algorithm is missing.

Step 1: Input a positive integer from the user and store it in the variable `number`.

Step 2: Divide `number` by 10 and record the integer quotient and the remainder. The integer quotient is the quotient with any part after the decimal point dropped. For example, when 127 is divided by 10, the quotient is 12.7, the integer quotient is 12 and the remainder is 7.

Step 3: (missing step)

Step 4: Repeat steps 2 and 3 until `number` is 0.

Which of the following can be used as step 3 so that the algorithm works as intended?

- (A) Step 3: Display the remainder of `number` divided by 10 and store the remainder in `number`.
  - (B) Step 3: Display the remainder of `number` divided by 10 and store the integer quotient in `number`.
  - (C) Step 3: Display the integer quotient of `number` divided by 10 and store the remainder in `number`.
  - (D) Step 3: Display the integer quotient of `number` divided by 10 and store the integer quotient in `number`.
43. Consider the following procedures for string manipulation.

| Procedure Call                  | Explanation                                                                                                                                                  |
|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>concat(str1, str2)</code> | Returns a single string consisting of <code>str1</code> followed by <code>str2</code> . For example, <code>concat("key", "board")</code> returns "keyboard". |
| <code>reverse(str)</code>       | Returns the reverse of the string <code>str</code> . For example, <code>reverse("abcd")</code> returns "dcba".                                               |

Which of the following code segments can be used to store "noon" in the string variable `word`?

- (A) `word ← "no"`  
`word ← concat(reverse(word), word)`
- (B) `word ← "no"`  
`word ← concat(reverse(word), reverse(word))`
- (C) `word ← "on"`  
`word ← concat(reverse(word), word)`
- (D) `word ← "on"`  
`word ← concat(reverse(word), reverse(word))`



## AP Principles 3.1, 3.2, 3.3, 3.4, 3.5 MCQ

44. Consider the following procedures for string manipulation.

| Procedure Call                             | Explanation                                                                                                                                                                                                                                                                                                             |
|--------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>concat(str1, str2)</code>            | Returns a single string consisting of <code>str1</code> followed by <code>str2</code> . For example, <code>concat("key", "board")</code> returns "keyboard".                                                                                                                                                            |
| <code>substring(str, start, length)</code> | Returns a substring of consecutive characters from <code>str</code> , starting with the character at position <code>start</code> and containing <code>length</code> characters. The first character of <code>str</code> is located at position 1. For example, <code>substring("delivery", 3, 4)</code> returns "live". |
| <code>len(str)</code>                      | Returns the number of characters in <code>str</code> . For example, <code>len("pizza")</code> returns 5.                                                                                                                                                                                                                |

Assume that the string `oldString` contains at least 4 characters. A programmer is writing a code segment that is intended to remove the first two characters and the last two characters from `oldString` and assign the result to `newString`.

For example, if `oldString` contains "student", then `newString` should contain "ude".

Which of the following code segments can be used to assign the intended string to `newString`?

Select two answers.

- A `newString ← substring(oldString, 3, len(oldString) - 4)`
- B `newString ← substring(oldString, 3, len(oldString) - 2)`
- C `tempString ← substring(oldString, 3, len(oldString) - 2)`  
`newString ← substring(tempString, 1, len(tempString) - 2)`
- D `tempString1 ← substring(oldString, 1, 2)`  
`tempString2 ← substring(oldString, len(oldString) - 2, 2)`  
`newString ← concat(tempString1, tempString2)`

## AP Principles 3.1, 3.2, 3.3, 3.4, 3.5 MCQ

45. The following procedures are available for string manipulation.

| Procedure Call                          | Explanation                                                                                                                                                                                                                                                                                                                       |
|-----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>substring(str, start, end)</code> | Returns a substring of consecutive characters of <code>str</code> starting with the character at position <code>start</code> and ending with the character at position <code>end</code> . The first character of <code>str</code> is considered position 1. For example, <code>substring("delivery", 3, 6)</code> returns "live". |
| <code>concat(str1, str2)</code>         | Returns a single string consisting of <code>str1</code> followed by <code>str2</code> . For example, <code>concat("key", "board")</code> returns "keyboard".                                                                                                                                                                      |
| <code>len(str)</code>                   | Returns the number of characters in <code>str</code> . For example, <code>len("key")</code> returns 3.                                                                                                                                                                                                                            |

A programmer wants to create a new string by removing the character in position `n` of the string `oldStr`. For example, if `oldStr` is "best" and `n` is 3, then the new string should be "bet". Assume that  $1 < n < \text{len}(\text{oldStr})$ .

Which of the following code segments can be used to create the desired new string and store it in `newStr`?

Select two answers.

- A `left ← substring(oldStr, 1, n - 1)`  
`right ← substring(oldStr, n + 1, len(oldStr))`  
`newStr ← concat(left, right)`
- B `left ← substring(oldStr, 1, n + 1)`  
`right ← substring(oldStr, n - 1, len(oldStr))`  
`newStr ← concat(left, right)`
- C `newStr ← substring(oldStr, 1, n - 1)`  
`newStr ← concat(newStr, substring(oldStr, n + 1, len(oldStr)))`
- D `newStr ← substring(oldStr, n + 1, len(oldStr))`  
`newStr ← concat(newStr, substring(oldStr, 1, n - 1))`

## AP Principles 3.1, 3.2, 3.3, 3.4, 3.5 MCQ

46. Assume that the variables `alpha` and `beta` each are initialized with a numeric value. Which of the following code segments can be used to interchange the values of `alpha` and `beta` using the temporary variable `temp`?

I. `temp ← alpha`  
`alpha ← beta`  
`beta ← temp`

II. `temp ← alpha`  
`beta ← alpha`  
`alpha ← temp`

III. `temp ← beta`  
`beta ← alpha`  
`alpha ← temp`

- (A) I and II only  
(B) I and III only  
(C) II and III only  
(D) I, II, and III
47. **Directions:** The question or incomplete statement below is followed by four suggested answers or completions. Select the one that is best in each case.

The code segment below is intended to swap the values of the variables `first` and `second` using a temporary variable, `temp`.

```
temp ← first
first ← second
<MISSING CODE>
```

Which of the following can be used to replace `<MISSING CODE>` so that the code segment works as intended?

## AP Principles 3.1, 3.2, 3.3, 3.4, 3.5 MCQ

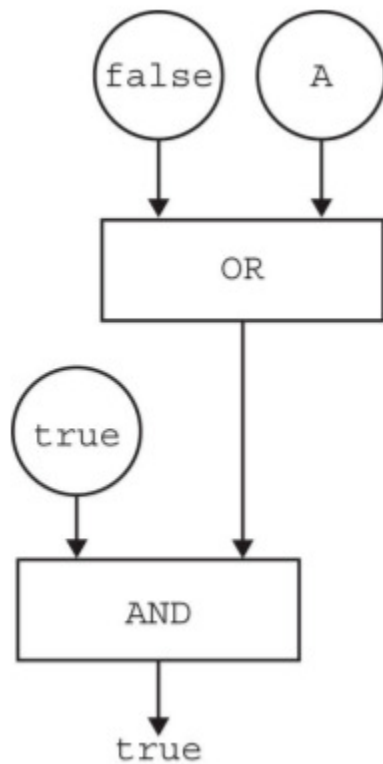
- (A) `second ← first`
- (B) `second ← temp`
- (C) `temp ← first`
- (D) `temp ← second`

48. Which of the following code segments can be used to interchange the values of the variables `num1` and `num2` ?

- (A) `num1 ← num2`  
`num2 ← num1`
- (B) `temp ← num1`  
`num1 ← temp`  
`num2 ← num1`
- (C) `temp ← num1`  
`num2 ← num1`  
`num1 ← temp`
- (D) `temp ← num1`  
`num1 ← num2`  
`num2 ← temp`

## AP Principles 3.1, 3.2, 3.3, 3.4, 3.5 MCQ

49. The figure below shows a circuit composed of two logic gates. The output of the circuit is *true*.



Which of the following is a true statement about input *A*?

- (A) Input *A* must be *true*.  
 (B) Input *A* must be *false*.  
 (C) Input *A* can be either *true* or *false*.  
 (D) There is no possible value of input *A* that will cause the circuit to have the output *true*.
50. Three words are stored in the variables `word1`, `word2`, and `word3`. The values of the variables are to be updated as shown in the following table.

| Variable           | Value Before Updating | Value After Updating |
|--------------------|-----------------------|----------------------|
| <code>word1</code> | "xylophone"           | "zebra"              |
| <code>word2</code> | "yarn"                | "yarn"               |
| <code>word3</code> | "zebra"               | "xylophone"          |

Which of the following code segments can be used to update the values of the variables as shown in the table?

## AP Principles 3.1, 3.2, 3.3, 3.4, 3.5 MCQ

- temp  $\leftarrow$  word1  
 (A) word3  $\leftarrow$  word1  
 word1  $\leftarrow$  temp
- temp  $\leftarrow$  word1  
 (B) word1  $\leftarrow$  word3  
 word3  $\leftarrow$  temp
- temp  $\leftarrow$  word1  
 (C) word1  $\leftarrow$  word2  
 word2  $\leftarrow$  word3  
 word3  $\leftarrow$  temp
- temp  $\leftarrow$  word3  
 (D) word3  $\leftarrow$  word2  
 word2  $\leftarrow$  word1  
 word1  $\leftarrow$  temp

51. Consider the following procedures for string manipulation.

| Procedure Call      | Explanation                                                                                                                                                                                                   |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| concat(str1, str2)  | Returns a single string consisting of str1 followed by str2. For example, concat("key", "board") returns "keyboard".                                                                                          |
| prefix(str, length) | Returns the first length characters of str or str if length is greater than the number of characters in str. For example, prefix("delivery", 3) returns "del" and prefix("delivery", 100) returns "delivery". |

The variable `initials` is to be assigned a string consisting of the first letter of the string `firstName` followed by the first letter of the string `lastName`. Which of the following assigns the correct string to `initials`?

- (A) `initials  $\leftarrow$  concat(prefix(firstName, 1), prefix(lastName, 1))`
- (B) `initials  $\leftarrow$  concat(prefix(firstName, 2), prefix(lastName, 2))`
- (C) `initials  $\leftarrow$  prefix(concat(firstName, lastName), 1)`
- (D) `initials  $\leftarrow$  prefix(concat(firstName, lastName), 2)`
52. The list `wordList` contains a list of 10 string values. Which of the following is a valid index for the list?
- (A) -1
- (B) "hello"
- (C) 2.5
- (D) 4

## AP Principles 3.1, 3.2, 3.3, 3.4, 3.5 MCQ

53. Consider the following code segment.

```
p ← 10
q ← 20
r ← 30
s ← 40
p ← q
q ← r
s ← q
r ← p
```

What is the value of `r` as a result of executing the code segment?

- (A) 10
  - (B) 20
  - (C) 30
  - (D) 40
54. In the following expression, the variable `truckWeight` has the value 70000 and the variable `weightLimit` has the value 80000.

```
truckWeight < weightLimit
```

What value does the expression evaluate to?

- (A) 70000
- (B) 80000
- (C) true
- (D) false

55. Consider the following code segment.

```
x ← 23
z ← x MOD y
```

Which of the following initial values of the variable `y` would result in the variable `z` being set to 2 after the code segment is executed?

## AP Principles 3.1, 3.2, 3.3, 3.4, 3.5 MCQ

- (A) 1
- (B) 2
- (C) 3
- (D) 4

56. Consider the following code segment.

```
a ← true
b ← false
c ← true
a ← (NOT (a OR b)) AND c
c ← c AND a
DISPLAY a
DISPLAY b
DISPLAY c
```

What is displayed as a result of executing the code segment?

- (A) true true true
- (B) false false false
- (C) true false true
- (D) false false true

57. Consider the following code segment.

```
first ← 100
second ← 200
temp ← first
second ← temp
first ← second
```

What are the values of `first` and `second` as a result of executing the code segment?

- (A) `first` = 100, `second` = 100
- (B) `first` = 100, `second` = 200
- (C) `first` = 200, `second` = 100
- (D) `first` = 200, `second` = 200



## AP Principles 3.1, 3.2, 3.3, 3.4, 3.5 MCQ

58. Consider the following code segment.

```
first ← true
second ← false
second ← first
first ← second
```

What are the values of `first` and `second` as a result of executing the code segment?

- (A) The value of `first` is `true`, and the value of `second` is `true`.
  - (B) The value of `first` is `true`, and the value of `second` is `false`.
  - (C) The value of `first` is `false`, and the value of `second` is `true`.
  - (D) The value of `first` is `false`, and the value of `second` is `false`.
59. Consider the following code segment.

```
a ← 10
b ← 20
c ← 30
d ← 40
x ← 20
b ← x + b
a ← x + 1
d ← c + d / 2
DISPLAY [a]
DISPLAY [b]
DISPLAY [c]
DISPLAY [d]
```

What is displayed as a result of executing the code segment?

- (A) 10 20 30 40
- (B) 21 30 40 50
- (C) 21 40 30 40
- (D) 21 40 30 50

**AP Principles 3.1, 3.2, 3.3, 3.4, 3.5 MCQ**

60. Consider the following code segment.

```
x ← 25
y ← 50
z ← 75
x ← y
y ← z
z ← x
```

Which of the variables have the value 50 after executing the code segment?

- (A) x only
- (B) y only
- (C) x and z only
- (D) x, y, and z