The AP CS Principles Exam Reference Sheet
Starts at page 125

Other Resources
Two resources come highly recommended by some of our 2016–17 teachers:

- Fast Track to a 5: Preparing for AP Computer Science Principles Examination ($19.50 from National Geographic Learning)
- Albert.io: Sample exam questions for AP CS Principles, organized by the “Big Ideas” of the framework, are available at: http://tiny.cc/dwulgy.

Multiple Choice
1. Consider the following code segment that appears in the middle of a program.

   ```plaintext
   DISPLAY "What is the password?"
   userPassword ← INPUT
   REPEAT UNTIL (missing statement)
   DISPLAY "Invalid, Try Again"
   userPassword ← INPUT
   ```

   Which of the following can replace the `missing statement` in the `REPEAT UNTIL` block so that the user will be required to enter the correct password of "swordfish" before they can continue on with the rest of the program.
   a. `userPassword = "swordfish"
   b. "swordfish"
   c. `userPassword ≠ "swordfish"
   d. `userPassword ← INPUT`

2. Which of the following could be considered part of the beginning “state” of a Scratch program?
   a. Visibility of sprites
   b. The background image
   c. The value of a variable
   d. All of the above

3. A large office building has an elevator that carries occupants between any of the building's 10 floors. The basement is referred to as "Level 0" while the topmost floor is "Level 9." The software for the elevator uses a variable, called `level`, to track the floor number of the elevator's current position. When a person presses a button requesting the elevator to rise to a higher floor, the following is invoked:
What is displayed if the elevator is currently on the 7th floor \((\text{level} = 7)\) and the person on the elevator presses a button that says to go up 3 floors \((\text{floors} = 3)\)?

a. Level 7 Level 8 Level 9
b. Level 8 Level 9 Cannot go up. Level 9
c. Level 8 Level 9 Level 10
d. Cannot go up.

4. Chad has written the majority of his code in Scratch and is ready to start thinking of test cases to make sure that his program functions properly, and when issues arise, fix them. This process is known as what?
   a. Program implementation
   b. Debugging
   c. Pseudocode
   d. Program detection

5. Consider the following code segments designed to find the area of a triangle \((A = \frac{1}{2} bh)\).

   **Program A**
   
   ```
   v1 ← INPUT
   v2 ← INPUT
   v3 ← v1 * v2 / 2
   DISPLAY v3
   ```

   **Program B**
   
   ```
   base ← INPUT
   height ← INPUT
   area ← base * height / 2
   DISPLAY area
   ```

Which of the following statements about the above programs is true?
   a. Both programs will work as intended, but Program B is more readable.
   b. Program A will work as intended, but Program B will not work as intended.
   c. Program B will work as intended, but Program A will not work as intended.
   d. Neither program will work as intended.
6. Which of the below options would be the best set of instructions to give for a program designed in Scratch?
   a. Make your way through the maze! Avoid the brain-eating zombies and be sure to collect the “hearts” for extra lives. Good Luck!
   b. Dodge zombies, gain lives, all while trying to make it through the maze! Click start to begin your exciting adventure.
   c. Click on the GREEN flag. Once the game starts, use the arrow keys to navigate your way through the maze. In your travels, collect the “hearts” for more lives and avoid being eaten by zombies.
   d. Ready, set, RUN!!!! Use your skills and intelligence to weave your way through the maze, avoiding obstacles and prove that you’ve got what it takes to survive!

7. Given the following code segment, what would be displayed if age were initialized with a value of 18?

   ```
   IF (age < 18) OR (age > 65)
   DISPLAY "group 1"
   ELSE
   DISPLAY "group 2"
   ```

   a. group 1
   b. group 2
   c. group 1 group 2
   d! Nothing will be displayed

8. Consider the following code segment that allows a customer to request their preferred beverage and size of beverage (ounces).

   ```
   ounces ← INPUT
   beverage ← INPUT
   IF beverage = "soda"
   IF ounces > 12
   DISPLAY "Bottle of " + beverage
   ELSE
   DISPLAY "Can of " + beverage
   ELSE
   IF beverage = "coffee"
   IF ounces > 16
   DISPLAY "Grande " + beverage
   ELSE
   DISPLAY "Short " + beverage
   ```

What is displayed if the user enters 16 ounces and coffee as their preferred beverage?
9. Which of the following would be the most appropriate name for a variable?
   a. variable1
   b. t
   c. amountOfTimeRemainingInTheGame
   d. time_left

10. While writing a program to regulate the speed of a self-driving car, you find that your software sometimes miscalculates the ideal car speed for city streets to be over 1500 MPH (nearly twice the speed of sound), when it should be approximately 30 MPH. Which of the following strategies would be best to employ in debugging your program?
   a. At the very end of the speed calculations, add an additional line of code that divides the calculated speed by 50 so that the program never produces such high speeds.
   b. After each calculation within your program, insert a temporary statement that displays the most recently calculated value. When running your program, compare the displayed values with the expected values to identify where in the program the error is being introduced.
   c. Starting at the end of your program and working backwards, systematically delete each line of code that relates to calculating and re-run the program after each deletion to identify where in the program the error is being introduced.
   d. Delete all of the code relating to speed calculations and rewrite it again.

11. The following procedure, validate(x), is intended to display “PASS” if an integer, x, is within the range of 128 through 32768, inclusive. Values of x that are not within the range should display “FAIL”.

   ```
   IF 128 ≤ x AND x ≤ 32768
   DISPLAY "PASS"
   ELSE
   DISPLAY "FAIL"
   ```

Which of the following sets of test cases would be sufficient for fully testing and verifying that this procedure executes as intended for all values of x?
   a. validate(127)
      validate(128)
      validate(2048)
      validate(32768)
      validate(32769)
   b. validate(100)
validate(0)
validate(10000)
validate(1000000)

d.
validate(128)
validate(2048)
validate(32768)

12. While developing a program, you find a similar project that someone has created and posted online. It contains a number of elements (e.g., images, music, code segments, etc.) that you would like to integrate into your own project. Under what conditions may you reuse these elements in your work?
a. You may never reuse someone else’s work.
b. You may reuse any elements that are posted publicly online as long as credit is given to their creator.
c. You may only reuse elements for which the original owner has granted a license to reuse, such as the Creative Commons Share Alike license.
d. You may always reuse anything that is posted publicly or privately online.

13. Consider the following:

```
total  0
count  1

REPEAT UNTIL  (count > 10)
  next  ←  INPUT
  total  ←  total + next
  count  ←  count + 1

average  total / 10
DISPLAY  average
```

Which of the following values is displayed if the user inputs the following list of values for each prompt:

```
1  2  3  4  5  6  7  8  9  15
```

a. 3
b. 4
c. 5
d. 6

14. Consider the following code.

```
REPEAT UNTIL(x > 10)
  x  ←  x * 2
DISPLAY  x
```
Assuming that before this code is run, \( x = 1 \). What would be displayed at the end?

a. 2
b. 16
c. 8
d. 1

15. Sam and Emma are creating a multiplayer tic-tac-toe game. Below is a segment of their code that is used so that the Sprite on screen can tell the user whose turn it is. Before each user’s turn, this set of code is run. What would condition 1 need to be so that this part of the program runs correctly? The variable `turn` is initialized as 0 at the start and player 1 always goes first.

```
IF CONDITION 1
  DISPLAY "Player 1's turn"
ELSE
  DISPLAY "Player 2's turn"
```

a. `turn MOD 2 = 1`
b. `turn MOD 2 = 0`
c. `turn > 0`
d. `turn = 1`

16. What condition will make the following an infinite loop?

```
y ← 2
REPEAT UNTIL (CONDITION)
y ← y - 5
```

a. \( y = -108 \)
b. \( y ≠ -3 \)
c. \( y ≥ 8 \)
d. \( y < -53 \)
17. Consider the following code segment:

```plaintext
IF (onTime)
   DISPLAY "Hello."
ELSE
    IF (absent)
       DISPLAY "Is anyone there?"
    ELSE
       DISPLAY "Better late than never."
ENDIF
```

If the variables `onTime` and `absent` both have the value `false`, what is displayed as a result of running the code segment?

a. Is anyone there?
b. Better late than never.
c. Hello. Is anyone there?

18. The following question uses a robot and a grid of squares. The robot is represented as a triangle, which is initially in the bottom left square of the grid and facing right.

Consider the following code segment, which moves the robot on the grid:

```plaintext
n ← 3
REPEAT 3 TIMES
   REPEAT n TIMES
      MOVE_FORWARD
      ROTATE_LEFT
      n ← n - 1
   END
END
```

Which of the following shows the location of the robot after running the code segment?

a.
19. Consider the following code segment:

```
i ← 0
sum ← 0

REPEAT UNTIL (i = 4)
  i ← i + 1
  sum ← sum + 1

DISPLAY sum
```

Which of the following best describes the result of running the code segment?

a. The number 0 is displayed.
b. The number 4 is displayed.
c. The number 10 is displayed.
d. Nothing is displayed; the program results in an infinite loop.
20. The block of code below is supposed to display “Multiple of 5” if the positive number value is in fact a multiple of 5.

```
IF (missing condition)
  DISPLAY "Multiple of 5"
ELSE
  DISPLAY "Incorrect"
```

Which of the following could be used in place of missing condition so the code will execute as intended?

a. (value MOD 1) = 5
b. (value MOD 5) = 1
c. (value MOD 0) = 5
d. (value MOD 5) = 0

21. Which of the following describes the output of the following code segment?

```
REPEAT RANDOM 1, 10 TIMES
  DISPLAY "Hi"
```

a. The word HI could be displayed 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, or 10 times
b. The word HI could be displayed 1, 2, 3, 4, 5, 6, 7, 8, 9, or 10 times
c. The word HI could be displayed 0, 1, 2, 3, 4, 5, 6, 7, 8, or 9 times
d. The word HI could be displayed 1, 2, 3, 4, 5, 6, 7, 8, or 9 times

22. Consider the following code segment:

```
A ← INPUT
B ← INPUT
C ← INPUT
IF (A < 0) AND (B ≥ 0) AND (C = 0)
  DISPLAY "Invalid Input"
```

What values, when inputted by the user, of A, B and C will display “Invalid Input”?

a. A = -10  B = 0  C = 4
b. A = 0  B = 0  C = 0
c. A = -1  B = -2  C = 0
d. A = -10  B = -1  C = 0
23. The volume of a rectangular prism is calculated by multiplying its length, width and height. What could be substituted into the section of the code marked < missing code > that would accurately calculate the volume based on the user input of l, w and h?

```
l <<- INPUT
w <<- INPUT
h <<- INPUT
volume <<- < missing code >
DISPLAY volume
```

a. l x w x h
b. l * w * h
c. l(w)(h)
d. l / w / h

24. What starting value of n would make this portion of the program repeat the block of code below the most amount of times?

```
REPEAT UNTIL (n > 10)
   IF (n * 2 < 15) THEN
      n <<- n + 3
   ELSE
      n <<- n + 1
```

a. 1
b. 2
c. 3
d. 4

25. Consider the block of code below:

```
IF (x < 10) missing Boolean Operator (x > 0)
DISPLAY "True"
```

What would be the most appropriate substitute for the missing Boolean Operator if the intention is to display “True” for only values of x between, but not equal to values of 0 and 10?
26. For what values of \( x \) and \( y \), when inputted into the program below, will the output display \( \text{Right Right} \)?

\[
\begin{align*}
x & \leftarrow \text{INPUT} \\
y & \leftarrow \text{INPUT} \\
\text{IF} \ (x = 0) \ OR \ (y \leq 0) & \\
\text{DISPLAY} \ "\text{Right}" \\
\text{ELSE} & \\
\text{DISPLAY} \ "\text{Wrong}" \\
\text{IF} \ (y > 0) \ AND \ (x = 0) & \\
\text{DISPLAY} \ "\text{Right}" \\
\text{ELSE} & \\
\text{DISPLAY} \ "\text{Wrong}" \
\end{align*}
\]

a. \( x \) must be 0 and \( y \) must be a positive number  
b. \( x \) cannot be 0 and \( y \) must be a negative number  
c. \( x \) and \( y \) must both be equal to 0  
d. No values of \( x \) and \( y \) will display \( \text{Right Right} \)

27. Below is a block of code intended to navigate a robot through a grid of squares.

\[
\begin{align*}
\text{REPEAT UNTIL} \ CAN\_MOVE \ right & \\
\text{MOVE\_FORWARD} & \\
\text{ROTATE\_RIGHT} & \\
\text{MOVE\_FORWARD} \\
\end{align*}
\]

For which of the follow grids will the code correctly navigate the robot to the final destination of the grey square?

a.
28. This is a section of code taken from a larger program.

```
IF value ≠ 4
    DISPLAY "missing output 1"
ELSE
    DISPLAY "missing output 2"
```

What outputs should be substituted in for “missing output 1” and “missing output 2”, based on the condition?

a. missing output 1: value is equal to 4  
missing output 2: value does not equal 4

b. missing output 1: value does not equal 4  
missing output 2: value is equal to 4

c. missing output 1: value does not equal 4  
missing output 2: value is greater than 4

d. missing output 1: value does not equal 4  
missing output 2: value does not equal 4
Multiple Response

29. Sally notices that she has the same set of 10 blocks in her code in multiple places. She decides to create a new block (procedure) in Scratch so that she can simply replace those 10 blocks with one procedure. Why would this be beneficial to Sally when she debugs and reasons through her program?
Select two answers.
a. The procedure makes the code section more abstract, so she doesn’t have to think through all 10 blocks each time she comes across them in her code.
b. The procedure will make the program more efficient, spending less time running the same set of 10 blocks over and over again.
c. If there is an error in the procedure, she can fix the error in the procedure without having to search through her code for each place the procedure is used.
d. She will have less code; therefore, making her program run quicker and easier to read.

30. What values are more likely to be displayed using the following block of code?

Select two answers.
a. 5
b. 12
c. 14
d. 20

31. Consider the following code segment that is intended to accept two integers, x and y, as input, and then display "yes" if and only if x is greater than y and y is less than or equal to 20. Otherwise, it should display "no".

Unfortunately, the above code does not perform as intended. Identify two different options that a programmer might choose, either of which will correct the code so that it performs as intended.
Select two answers.
a. Swap the first two input/assignment blocks (i.e., x ← INPUT, y ← INPUT)
b. Change the condition in the IF block to be: IF x > y AND y ≤ 20
c. Change the condition in the IF block to be: IF x > y OR y ≤ 20
32. Which of the following are true about programming documentation?
   Select two answers:
   a. It is useful to other programmers that view your code, so that they can understand what different parts of the code are intended to do.
   b. It is needed when working in a group dynamic, but not very beneficial to the programmer when they are working alone.
   c. It allows the programmer an opportunity to attribute help, work and code from others.
   d. It should be written only at the end of the program, after you have thoroughly tested all aspects of your code.

33. A student developed a program that outputs the name of a fruit that begins with a letter, dependent upon the variable keyPressed, which stores the letter (from A to Z only) a user types on the keyboard. Below is a section of code from her program:

   ```
   IF keyPressed = "A"
   DISPLAY "Apple"
   ```

Which of the following descriptions below would be a way that this student might have written the rest of her code so that it executes as intended? Select two answers.
   a. Use 25 nested if / else blocks where the if portion is formatted like the code segment above (changing the letters of the alphabet and fruits) and the else simply holding the next if portion until the last else, which displays a fruit that begins with Z.
   b. Take the above code and insert it into a repeat block that repeats 26 times.
   c. Use 26 if / else blocks where the if portion is formatted like the code segment above (changing the letters of the alphabet and fruits) and each else portion displays “You did not choose this letter”.
   d. Use 26 if blocks formatted similarly to the one above (changing the letters of the alphabet and fruits).

34. The following uses a robot in a grid of squares. The robot is represented by a triangle and is in the upper left corner facing toward the bottom of the grid.

Which blocks of code will properly navigate the robot to the final destination of the grey square in the bottom right corner of the grid?
Select two answers.
   a.
35. Below is a program that is supposed to be a “Guess a Number” game, wherein the user is trying to accurately guess a randomly generated number between 1 and 100. However, the program is not functioning as intended.
Which two lines in the program need swapped in order for this program to work correctly?
Select two answers.

a. LINE 2
b. LINE 3
c. LINE 4
d. LINE 5