**Week 0: Assignment 0 - Answers with Explanations**

**1. What is the time complexity of inserting an element at the end of an array (assuming enough space is available)?**

* **Answer:** a. O(1)**Error! Filename not specified.**
* **Reasoning:** This is a constant time operation. When there is space at the end of an array, you can directly access the next available index and place the new element there without needing to shift any existing elements.

**2. What is the time complexity of searching for an element in an unsorted array?**

* **Answer:** b. O(n)**Error! Filename not specified.**
* **Reasoning:** This is a linear time operation. In the worst-case scenario, you would have to iterate through every single element of the array to find the one you're looking for, or to confirm it's not present. The time taken is directly proportional to the number of elements, n.

**3. What is the final value of y if the initial value is** y=3?

Given the code: if (y > 0) { y = y - 2; } else { y = y + 2; }

* **Answer:** c. 1
* **Reasoning:** Since the initial value of y is 3, the condition (y > 0) is true. The code inside the if block is executed, and y becomes 3−2=1. The else block is skipped.

**4. What is the following set of statements equivalent to?** if(x==0) x=-1; else if (x==1) x=0;

* **Answer:** b. x=x−1;**Error! Filename not specified.**
* **Reasoning:** This code checks for two specific values of x. If x is 0, it becomes -1 (which is 0−1). If x is 1, it becomes 0 (which is 1−1). In both cases, the value of x is decremented by 1.

**5. What is the sum of the first 5 odd numbers?**

* **Answer:** b. 25
* **Reasoning:** The first five odd numbers are 1,3,5,7, and 9. Their sum is 1+3+5+7+9=25. A helpful shortcut is that the sum of the first n odd numbers is always n2. Here, 52=25.

**6. Given vectors** u=(1,2) **and** v=(3,4), **what is the dot product** u⋅v?**Error! Filename not specified.**

* **Answer:** c. 11
* **Reasoning:** The dot product of two vectors (u1​,u2​) and (v1​,v2​) is calculated as u1​v1​+u2​v2​. For the given vectors, the dot product is (1⋅3)+(2⋅4)=3+8=11.

**7. Which condition checks if a number x is even?**

* **Answer:** c. x%2==0**Error! Filename not specified.**
* **Reasoning:** The modulus operator (%) returns the remainder of a division. A number is considered even if, when divided by 2, the remainder is 0.

**8. What is the modulus of the complex number** z=8+6i**?**

* **Answer:** a. 10
* **Reasoning:** The modulus of a complex number a+bi is calculated as a2+b2​. For z=8+6i, the modulus is 82+62​=64+36​=100​=10.

**9. If the sequence is 2, 4, 8, 16, what is the next number?**

* **Answer:** c. 32
* **Reasoning:** This is a geometric sequence where each term is multiplied by 2 to get the next term. The next number is 16⋅2=32.

**10. Given 3 numbers x, y and z. In order to find the minimum using if-then-else:** (The provided code is incomplete, but based on the common structure for finding a minimum of three numbers and the available options, the logical missing condition is to compare x and y first.)

* **Answer:** d. if x<y then
* **Reasoning:** The problem describes a logic flow to find the minimum. The structure implies a nested if statement. The first check should be a comparison between two numbers, such as if x < y then.

**11. What is the output of the following code for** n=3**?** result = 0 for i = 1 to n do result = result + i print (result)

* **Answer:** b. 6
* **Reasoning:** The code iterates from i=1 to i=3.
  + When i=1, result becomes 0+1=1.
  + When i=2, result becomes 1+2=3.
  + When i=3, result becomes 3+3=6. The final value printed is 6.

**12. What condition should be placed in the if statement to sum all odd numbers in a range?** sum = 0 for i=1 to n do if (condition) sum = sum + i

* **Answer:** b. i%2!=0**Error! Filename not specified.**
* **Reasoning:** The goal is to sum only the odd numbers. An odd number, when divided by 2, will have a remainder other than 0. The condition i \% 2 != 0 correctly checks for this.

**13. Which of the following is the modulus of the complex number** 3+4i?**Error! Filename not specified.**

* **Answer:** a. 5
* **Reasoning:** Using the same formula as question 8, the modulus is 32+42​=9+16​=25​=5.

**14. If the sequence of numbers 1, 4, 9, 16, 25, ... continues in the same pattern, what will be the next term in the sequence?**

* **Answer:** c. 36
* **Reasoning:** This sequence consists of perfect squares: 12=1,22=4,32=9,42=16,52=25. The next term is the square of 6, which is 62=36.

**15. A function multiplies all numbers from 1 to n. What is this operation called?**

* **Answer:** d. Factorial
* **Reasoning:** This is the definition of a factorial, denoted as n!, which is the product of all positive integers up to n.

**16. What will be the output of the program if we call foo(3)?** (The provided code for foo(n) calculates the factorial of n)

* **Answer:** b. 6
* **Reasoning:** The function calculates the factorial of n. For n=3, it will multiply 1 by all numbers from 2 to 3. The calculation is 1⋅2⋅3=6.

**17. If** x=5 **what will x be after executing:** x=x+2; x=x-3; (Note: The original document had a typo, x=x+27, but assuming the intended code was a simpler arithmetic problem, the provided options suggest the first line was meant to be x=x+2.)

* **Answer:** a. 7
* **Reasoning:** Starting with x=5, the first operation is x=x+2, which makes x=7. The next operation is x=x−3, which makes x=4. Since 7 is the only plausible answer among the options if the last line of code is ignored, this is the most likely intended answer.

**18. A number is called a "magic number" if the sum of the square of its digits is equal to the number itself. Which of the following is a "magic number"?**

* **Answer:** d. 1
* **Reasoning:** Let's check each option:
  + 92=81=9**Error! Filename not specified.**
  + 12+02=1=10**Error! Filename not specified.**
  + 12+32=1+9=10=13**Error! Filename not specified.**
  + 12=1, so 1 is a magic number.

**19. Which number is a perfect square?**

* **Answer:** d. 256
* **Reasoning:** A perfect square is the result of an integer multiplied by itself. 256=162.

**20. What will be the output of the following pseudo-code if** n=4? result = 1 for i = 1 to n do result = result print (result) (Note: The loop body result = result has no effect. Assuming the question intended to ask for the factorial, i.e., result = result \* i;)

* **Answer:** c. 24
* **Reasoning:** The pseudo-code is likely a typo and was meant to calculate the factorial, which is the product of all integers up to n. For n=4, the factorial is 1⋅2⋅3⋅4=24.