Editorial-Solution-W1A1: Building Blocks of Programming

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1. How do you access the third element in a list named my_list?

Options:

- a) my_list3
- b) my_list[2]
- c) my_list(3)
- d) my_list.get(3)

Answer: b) my_list[2]
Solution: In Python, list indexing starts at 0. To access the third element, you use the index 2. For example, if my_list = [10, 20, 30, 40], then my_list[2] will return 30.

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2. What is the output of print(len([1, 2, 3, 4, 5]))?

Options:

- a) 15
- b) 5
- c) [1, 2, 3, 4, 5]
- d) Error

Answer: b) 5
Solution: The len() function calculates the number of elements in a list. In this case, [1, 2, 3, 4, 5] contains five elements. Therefore, the output is 5.

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3. When using AI for multiple-choice questions, what's a good practice to improve output?

Options:

- a) Always ask for 10 questions at once
- b) Never provide examples
- c) Include research-based guidelines in the prompt
- d) Use only yes/no questions

Answer: c) Include research-based guidelines in the prompt
Solution: Providing clear and research-based guidelines helps AI generate more accurate and relevant outputs. Examples and context improve the quality of responses.

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4. The birthday paradox is considered a paradox because:

Options:

- a) It's mathematically impossible
- b) It contradicts common intuition
- c) It only works for leap years
- d) It requires exactly 365 people

Answer: b) It contradicts common intuition
Solution: The birthday paradox surprises people because they underestimate how quickly probabilities grow with group size. For example, with just 23 people in a room, there's about a 50% chance that two share a birthday.

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5. In a room of 23 people, what is the approximate probability that at least two people share the same birthday?

Options:

- a) 25%
- b) 50%
- c) 0%
- d) 100%

Answer: b) 50%
Solution: With just 23 people in a room, there's about a 50% chance of at least two sharing a birthday due to the high number of possible pairings (combinatorics).

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6. Which of the following correctly creates an empty list in Python?

Options:

- a) list = []
- b) list = {}
- c) list = ()
- d) list = ''

Answer: a) list = []
Solution: In Python, an empty list is created using square brackets ([]).
Options {} and () create an empty dictionary and tuple, respectively.

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7. What is the output of print([1, 2, 3] * 2)?

Options:

- a) [2, 4, 6]
- b) [1, 2, 3, 1, 2, 3]
- c) [1, 1, 2, 2, 3, 3]
- d) Error

Answer: b) [1, 2, 3, 1, 2, 3]
Solution: The multiplication operator (*) duplicates the contents of a list when multiplied by an integer. Here [1, 2, 3] * 2 creates [1, 2, 3] twice.

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8. A simple Python program:

```
name = input("What's your name? ")

print(f"Hello, {name}!")
```

Which prompt would be best to generate this program? **Options:**

- a) Write a Python program that asks for the user's name and greets them.
- b) Create a function that calculates the square of a number.
- c) Implement a program to check if a number is prime.
- d) Write code to sort a list of integers in ascending order.

Answer: a) Write a Python program that asks for the user's name and greets them. **Solution:** This prompt directly describes what the program does: asking for user input and printing a greeting.

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9. Which prompt would be best to generate this program?

```
numbers = [1, 2, 3, 4, 5]

sum_of_numbers = sum(numbers)

print(f"The sum is: {sum_of_numbers}")
```

Options:

- a) Create a program that finds the largest number in a list.
- b) Write a Python script to calculate the sum of numbers in a list.
- c) Implement a function to reverse a string.
- d) Develop a program that checks if a year is a leap year.

Answer: b) Write a Python script to calculate the sum of numbers in a list.

Solution: This prompt accurately describes the program's functionality: summing up numbers in a list.

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10. Which prompt would be best to generate this program?

```
numbers = [1, 2, 3, 4, 5]

max_of_numbers = max(numbers)

print(f"The maximum is: {max_of_numbers}")
```

Options:

- a) Create a program that finds the largest number in a list.
- b) Write a Python script to calculate the sum of numbers in a list.
- c) Implement a function to reverse a string.
- d) Develop a program that checks if a year is a leap year.

Answer: a) Create a program that finds the largest number in a list.
Solution: This prompt accurately describes the program's functionality: finding the largest number in a list.

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11. Which prompt would be best to generate this program?

```
import random

number = random.randint(1, 100)

print(f"Random number between 1 and 100: {number}")
```

Options:

- a) Write a program to calculate the average of numbers in a list.
- b) Create a script that generates a random number between 1 and 100.
- c) Implement a function to check if a string is a palindrome.
- d) Develop a program that converts decimal numbers to binary.

Answer: b) Create a script that generates a random number between 1 and 100.
Solution: This prompt directly describes the program's purpose: generating a random number within a specified range.

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12. Which of the following is NOT a type of runtime available in Google Colab?

Options:

- a) CPU
- b) GPU
- c) TPU
- d) APU

Answer: d) APU
Solution: Google Colab provides CPU (default), GPU (for faster computation), and TPU (Tensor Processing Unit). However, APU (Accelerated Processing Unit) is not available.

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13. A researcher is exploring the Library of Babel, which contains every possible 410-page book composed of lowercase letters, spaces, commas, and periods. She wants to find a specific sentence that she believes holds the key to a scientific breakthrough. The sentence is 20 words long and contains only lowercase letters and spaces. Assuming there are 26 lowercase letters plus the space character (total 27 characters), approximately how many books would the researcher need to check, on average, before finding the desired sentence?

Options:

- a) 27^20 (approximately 3.7×10^28) books
- b) 20^27 (approximately 1.3×10^35) books
- c) 410×27^20 (approximately 1.5×10^31) books
- d) (27^20) / 2 (approximately 1.85×10^28) books

Answer: d) (27^20) / 2 (approximately 1.85×10^28) books
Solution: The total number of possible 20-word sentences using 27 characters is 27^20. However, on average, the researcher would need to search through half of the possible books before finding the desired sentence. Therefore, the expected number of books to check is (27^20) / 2, which is approximately 1.85×10^28 books.

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14. The birthday paradox demonstrates a principle that applies to many real-world scenarios. Which of the following is NOT a practical application of this principle?

Options:

- a) Cryptographic hash collision resistance
- b) Genetic testing for rare diseases
- c) Weather prediction accuracy
- d) Database indexing efficiency

Answer: c) Weather prediction accuracy
Solution: The birthday paradox principle applies to scenarios involving unexpected collisions or matches in large datasets, such as cryptographic hashes and genetic markers. However, weather prediction accuracy is not directly related to this principle, making it the outlier.

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15. In a group of 70 people, what is the approximate probability that at least two people share the same birthday?

Options:

- a) 50%
- b) 75%
- c) 99.9%
- d) 100%

Answer: c) 99.9%
Solution: This question requires understanding that the probability of a shared birthday increases rapidly with group size. With 70 people, the probability is extremely high, surpassing 99.9%. This demonstrates how quickly the probability approaches certainty as the group size increases beyond the often-cited 23 people for a 50% chance.