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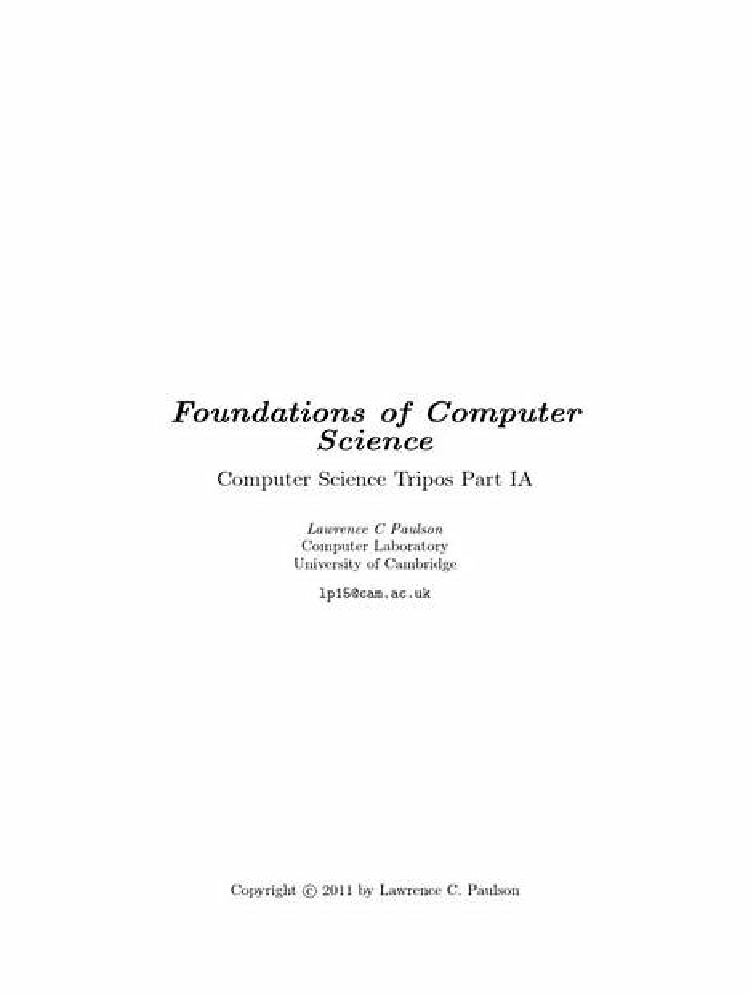

Foundations of Computer Science

Computer Science Tripos Part IA

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WGU Foundations of Computer Science Sample Questions (Q12-Q17):

NEW QUESTION # 12
What is the expected result of running the following code: list1[0] = "California"?

- A. A new list will be created with the value "California".
- B. The first value in the list will be replaced with "California".
- C. The list will be extended by adding "California" at the end.
- D. A second element will be added to the line "California".

Answer: B

Explanation:
Python lists are mutable sequences, which means elements can be changed in place after the list has been created. The expression list1[0] = "California" uses indexing to target the element at position 0 (the first element, because Python uses zero-based indexing) and assignment (=) to replace that element with a new value. As a result, the list keeps the same length, but its first entry becomes "California".
This operation does not create a new list (so option A is incorrect); it modifies the existing list object referenced by list1. It also does not append to the end of the list (so option C is incorrect). Appending would use methods like list1.append("California"). Option D is not meaningful in Python list semantics; assignment to a single index replaces exactly one element rather than "adding a second element to the line." Textbooks highlight this difference between mutable and immutable sequence types. For example, strings are immutable, so you cannot assign to some_string[0]. Lists, however, are designed for collections that change over time, supporting updates, insertions, deletions, and reordering. Index assignment is fundamental for many algorithms: updating an array-like buffer, modifying a dataset row, replacing incorrect values, or implementing in-place transformations efficiently.

NEW QUESTION # 13
How can a user subset a NumPy array bmi to only include values over 23?

- A. bmi.get_values(>23)
- B. bmi[bmi > 23]
- C. bmi.where(bmi > 23)
- D. bmi.select(23)

Answer: B

Explanation:
NumPy supports a powerful technique calledBoolean indexing(also called Boolean masking) to filter arrays based on a condition. When you write bmi > 23, NumPy performs an element-wise comparison and produces a Boolean array of the same shape, containing True where the condition holds and False otherwise. Using that Boolean array inside square brackets, as in bmi[bmi > 23], tells NumPy to return a new 1D array containing only the elements whose mask value is True. This approach is heavily emphasized in scientific computing curricula because it expresses selection logic without explicit loops and runs efficiently in optimized compiled code.
Option B looks close but is not standard NumPy usage. The function commonly used is np.where(condition) or np.where(condition, x, y). While np.where(bmi > 23) can return indices, bmi.where(...) is not a NumPy array method; it is more associated with pandas objects. Options A and C are not valid NumPy APIs for filtering.
Boolean indexing is central in data analysis tasks such as removing invalid measurements, selecting a population subgroup, applying thresholds, and building feature subsets. It composes cleanly with vectorized computation, for example bmi[bmi > 23].mean(), enabling concise and high-performance numerical workflows.

NEW QUESTION # 14
Which statement describes the relationship between trees and graphs?

- A. Trees cannot have cycles.
- B. Trees do not have levels.
- C. Trees can have cycles.
- D. Trees can have unconnected nodes.

Answer: A

Explanation:
In discrete mathematics and computer science, atreeis a special kind ofgraph. The standard graph-theory definition is that a tree is aconnected, acyclicundirected graph. "Acyclic" means it containsno cycles, i.e., you cannot start at a vertex, follow a sequence of edges, and return to the starting vertex without repeating edges in a way that forms a loop. (Wikipedia) This property is exactly what makes option D correct.
The other options contradict the definition. If a structure has cycles, it is not a tree (though it may still be a graph). If it has unconnected nodes, it is not connected; such a structure is more like aforest(a disjoint union of trees) rather than a single tree. (Wikipedia) The idea of "levels" belongs to a particular computer-science representation called arooted tree, where one node is chosen as the root and nodes can be assigned depths
/levels based on distance from the root. But levels are not required in the abstract definition of a tree as a graph; they arise from choosing a root and orientation for convenience in algorithms like BFS/DFS, heaps, and parse trees.
So, the relationship is: every tree is a graph with extra structure-specifically, no cycles and (typically) connectivity-and the "no cycles" rule is the key distinguishing feature. (Discrete Mathematics)

NEW QUESTION # 15
How does the data type of a variable get set in Python?

- A. It is always set to string by default.
- B. It is chosen randomly.
- C. It is explicitly declared by the programmer.
- D. It is determined by the value assigned to it.

Answer: D

Explanation:
Python usesdynamic typing, a core concept emphasized in programming language textbooks. In dynamically typed languages, a variable name does not permanently "own" a type. Instead, theobjectcreated by an expression has a type, and the variable becomes a reference to that object. Therefore, the type associated with a variable at any moment is determined by the value assigned to it. For example, after x = 7, x refers to an integer object. After x = "seven", the same name now refers to a string object. The type changes because the binding changes, not because the variable's type declaration was edited.
Option A describesstatic typingsystems (common in languages like Java, C, or C++), where programmers declare types and compilers enforce them. Python does not require such declarations for ordinary variables.
Option B is incorrect because type assignment is deterministic, not random. Option C is incorrect because Python does not default variables to strings; it assigns whatever type results from the right-hand-side expression.
This model is closely tied to Python's runtime behavior: type checks occur during execution, and functions can accept values of different types as long as the operations used are valid (often discussed as
"duck typing"). This flexibility supports rapid development, but also motivates careful testing and, in larger systems, optional type hints for documentation and tool support.

NEW QUESTION # 16
Which statement describes the data type restriction found in most NumPy arrays?

- A. NumPy arrays must be of the same type of data.
- B. NumPy arrays are restricted to string data types only.
- C. NumPy arrays adapt to the most complex data type on the fly.
- D. NumPy arrays can only hold integer data types.

Answer: A

Explanation:
Most NumPy arrays enforce a key constraint: all elements share the samedtype(data type). This uniform typing is foundational to NumPy's performance model. Because each element has the same size and representation, NumPy can store the array in a contiguous memory block and apply low-level, vectorized operations efficiently. This is why NumPy is widely used for numerical computing, statistics, and data analysis: operations like addition, multiplication, and reductions (sum/mean) can be implemented in optimized compiled code without per-element Python overhead.
Option B captures this textbook principle: elements in a typical ndarray are of the same data type. The other options are incorrect. NumPy is not restricted to strings (A), and it is not limited to integers (C); it supports floats, complex numbers, booleans, fixed-width strings, datetime types, and many others. Option D is misleading: NumPy does not continuously "adapt on the fly" during normal use. The dtype is generally fixed once the array exists. What NumPydoesdo is choose an appropriate common dtype when you create an array from mixed inputs (for example, mixing ints and floats yields floats). But after creation, assignments are cast into the existing dtype rather than dynamically changing the dtype to accommodate new values.
This restriction is precisely what differentiates NumPy arrays from Python lists and enables predictable memory layout and fast numerical computation.

NEW QUESTION # 17
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