Question 1: Explanation

In Question1, the function takes two strings (s and t) and finds out whether one string (t) is anagram of the other (s). Here, in the string t, all the different letter combinations are considered to find out anagrams. If an anagram is found, the program returns true.

The efficiency of the program depends on how long the given strings are. However, to increase the time efficiency imported itertools.permutations() function is used to generate different letter combinations in a word.

word\_combination\_list = list(itertools.permutations(t\_list, len(t\_list)))

This function is helpful to eliminate unnecessary ‘for’ loop iterations and complexity of the codes. Since minimum number of variables are used to store data during the program running, the space efficiency also in good standing.

Question 2: Explanation

In this function, the longest palindromic substring is found in a given string. To achieve this, a substring is divided in to two from the center and check whether one part is matching to reverse of the other.

The overall efficiency of this function also depends on the length of the string. Minimum number of variables used to increase the space efficacy. Using isOdd() function, code repetition is minimized. Also, minimize the unnecessary looping, following string reverse method is used.

second\_part = substring[center:][::-1]

These measures helped to improve time efficiency.

Question 3: Explanation

In this question, minimum spanning path for the given graph is determined. First the dictionary form of the graph is converted to Graph object. The Graph object contains the sun objects Nodes and Edges. The path finding is carried out. The total value of the edges (lowest values) for each possible path that contain all the nodes is considered to find the minimum spanning path.

The time taken to run the program is depend on how many nodes and edges are in the graphs. The high numbers of nodes and edges can be increase the computational time exponentially (typical for graphs).

To increase the time efficacy, some iterations are minimized by using inbuilt methods like in following code line. Depth first search algorithm used to find paths.

path[::-1]

Several functions are used to minimize the code repetition.

Following data structures used to define Graph object.

class GNode(object):

def \_\_init\_\_(self, value):

self.value = value

self.edges = []

self.visited = False

class Edge(object):

def \_\_init\_\_(self, value, node\_from, node\_to):

self.value = value

self.node\_from = node\_from

self.node\_to = node\_to

class Graph(object):

def \_\_init\_\_(self, nodes=None, edges=None):

self.nodes = nodes or []

self.edges = edges or []

self.node\_names = []

self.\_node\_map = {}

Question 4: Explanation

This function finds the least common ancestor for given two nodes. the least common ancestor is the farthest node from the root that is an ancestor of both nodes. Th the beginning of the function, the binary search tree (BST) in a matrix form is converted in to BST object. The following codes shows the definition of BST object.

class BNode(object):

def \_\_init\_\_(self, value):

self.value = value

self.left = None

self.right = None

class BST(object):

def \_\_init\_\_(self, root):

self.root = BNode(root)

Inheritably, BST are easy to navigate data structures. Hence, the program also efficient. Based on the BST rules, the best case happens if the following conditions are met.

if (n1 < r and n2 > r) or (n2 < r and n1 > r)

In this case, there is no need to search through the BST, because the least common ancestor for the given numbers is the root. Hence, to increase the efficiency of the program, above conditions is checked before implementing other tasks. If the conditions are true function returns the root as least common ancestor and complete the run. In this part also, several local functions and an in-built function (find\_path\_to\_helper) to BST class are used to minimize the code repetition.

Question 5: Explanation

The function question5() is written to find the element in a singly linked list that's m elements from the end.

Following data objects were designed to store data.

class LLNode(object):

def \_\_init\_\_(self, data):

self.data = data

self.next = None

class LinkedList(object):

def \_\_init\_\_(self, head=None):

self.head = head

The function get\_length() is designed to get the length of a linked list before start to find the m th element from the end. Getting the length of the linked list first is making easier and efficient the latter implementation such as navigation to the specific value of the linked list. Specially in this particular case, navigate to a specific number from the end of the linked list can be efficiently done when the length of the list is known.