Mid Term Exam

Seneca | SCHOOL OF INFORMATION AND COMMUNICATIONS TECHNOLOGY

TERM	COURSE NAME	Professor	COURSE CODE
Fall 2023	Data Structures and Algorithms	Elham Ahmadi	DSA456

Name	
Student Number	
Section	

DATE: Oct 18th, 2023

TIME ALLOWED: 2 hours

TOTAL MARKS 50 MARKS

SENEC 'S ACADEMIC HONESTY POLICY

As a Seneca student, you must conduct yourself in an honest and trustworthy manner in all aspects of your academic career. A dishonest attempt to obtain an academic advantage is considered an offense, and will not be tolerated by the College.

Question 1 (15 marks): Hash Tables

Suppose you were given records with the following keys (the values are irrelevant to this discussion). The hash values for the keys are in the given table:

Key	Hash(key)
ash	17
bee	33
cow	55
data	18
eel	24
fly	46
glue	37
hip	30
ice	56
jam	19
kiwi	61

a) Using "**linear probing without tombstones"**, insert the following keys in the order given into the table below:

bee, cow, data, eel

0	1	2	3	4	5	6	7	8	9

b) Now, insert that old list as "bee, cow, data, eel" into this table:

0	1	2	3	4

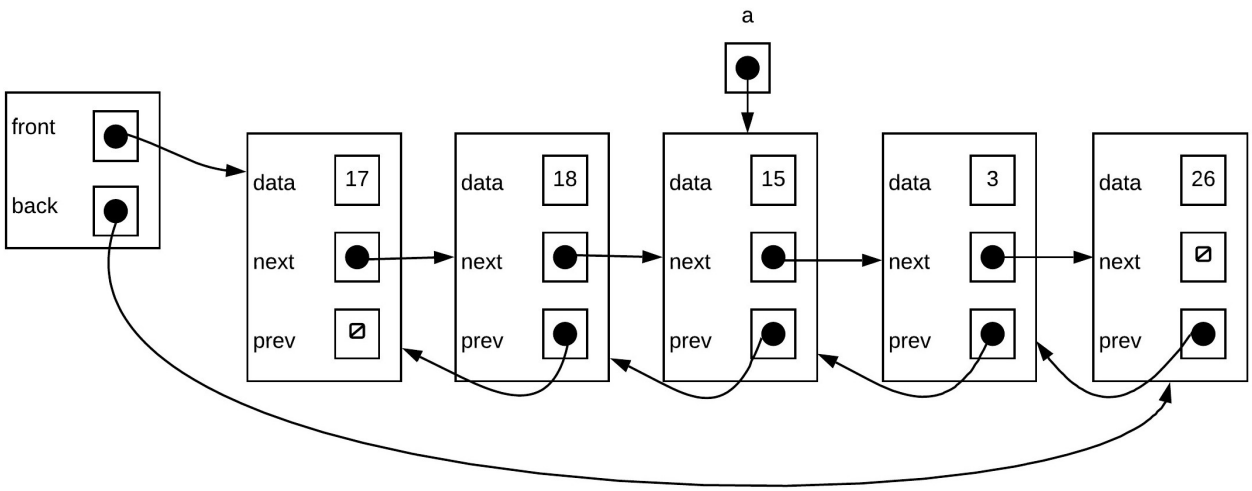
c) Suppose you were given the following table, what would the table look like if you were to remove **jam**

make sure to cross out any key that is no longer where they use to be. Explain your answer to get full mark.

hip	glue	kiwi	bee				ash	data	jam
0	1	2	3	4	5	6	7	8	9

Question 2 [10 marks]:

The drawing below shows the current state of a linked list.



a) Alter the above diagram-as altering the connectivity between nodes to show what the list would look like if you were to perform the following code blurb onthe list: (you can do the drawing on paint/word/hand writing whatever you prefer.)

```
a.prev.next =a.next
a.next.prev = a.prev
a.next = self.front
a.prev=None
self.front.prev=a
```

b) The above code aims at moving the node a points at (the one with 15) to the front of the list, but still there is onemissing line code at the end of code. Write down that single line of code.

Question 3 [10 marks]:

Perform an analysis of each of the following functions with respect to number. You should provide mathematical analysis for each section.

```
def function1(number):
      i = 1
      rc = 0
      while(i< number):
            rc+=1
            i=i*2
      return rc
```

```
def function2(number):
      i = 0
      rc = 0
      while (i< 5):
            rc+=number
            i+=1
      return rc
```

```
def function3(number):
      i = 0
      rc = 0
      while(i< number):
            i+=1
            rc+=1
            number=number//2   #(for example: 4//2=2, 10//3=3)
      return rc
```

Question 4 [5 marks]:

Analyze the following recursive function with respect to **number**:

```
def  recursive (x, number):
    if  number==0:
        return 0
    elseif   number==1:
            return x
    else:
        return x+ recursive(x,number-1)
```

Question 5 : 10 marks

Show step by step how 1) quick sort and 2) Selection sort works on array [8,10,15,3,13,9,8]? Explain the details of each step. You can type here the answer, or attaching a picture of hand written solution