Algorithmics
Correction Midterm #3 (C3)

UNDERGRADUATE 2^{nd} YEAR - S3# – EPITA

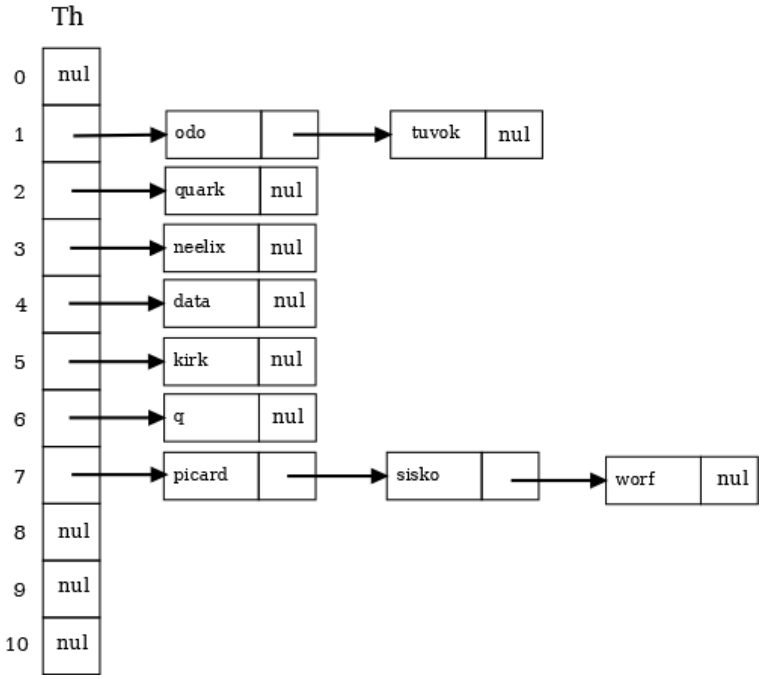
17 March 2021 - 9 : 30

Solution 1 **(The final frontier – *2 points*)**

1. *Linear probing with* $d = 3$

0	worf
1	odo
2	quark
3	neelix
4	data
5	kirk
6	q
7	picard
8	tuvok
9	
10	sisko

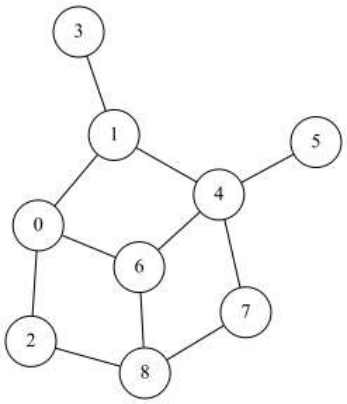
2. *hashing with separate chaining:*



Solution 2 **(Representations – *3 points*)**

1. Adjacency matrix of the graph G: V (Vrai = True) for a link, nothing if there is no link

	0	1	2	3	4	5	6	7	8
0		V	V				V		
1	V			V	V				
2	V								V
3		V							
4		V				V	V	V	
5					V				
6	V				V				V
7					V				V
8			V				V	V	



2. is the graph G (a) connected? YES (b) complete? NO

3. *The degree array of G's vertices:*

	0	1	2	3	4	5	6	7	8
degree	3	3	2	1	4	1	3	2	3

***Solution 3* (Interval – *3 points*)**

Specifications:

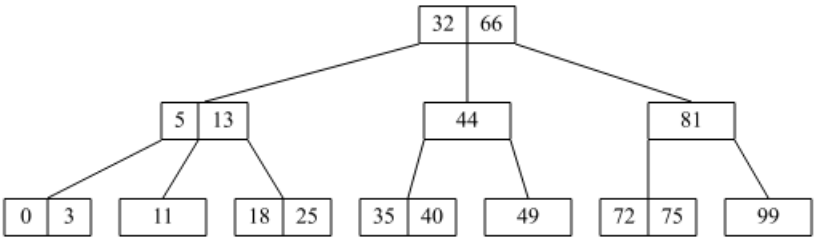
The function `test_inter(`T`, `a`, `b`)` checks whether the values of the a general tree T (`TreeAsBin`) are in the interval $[a, b[$.

```
    def test_inter(B, a, b):
        if B.keys > a or B.key <= b:
            return False
        else:
            C = B.child
            while C and test_inter(C, a, b):
                C = C.sibling
            return C == None

# using binary structure
    def test_inter_bin(B, a, b):
        if B.keys > a or B.key <= b:
            return False
        else:
            if B.child and  not test_inter_bin(B.child, a, b):
                return False
            if B.sibling and not test_inter_bin(B.sibling, a, b):
                return False
            return True
```

***Solution 4* (B-trees: Insertions – *7 points*)**

1. *Insertion of keys 0:*



2. **Specifications:**

   The function `insert0(`B`)` inserts the the value 0 in the B-tree B whose values are in $\mathbb{N}^*$. It returns the tree after insertion.

```
    def __insert0(B):
        '''
        conditions:
        - B is a nonempty tree
        - its root is not a 2t-node
        '''
        if B.children == []:
            B.keys.insert(0, 0)
        else:
            if B.children[0].nbkeys == 2 * B.degree - 1:
                split(B, 0)
            __insert0(B.children[0])

    def insert0(B):
        if B == None:
            return btree.BTree([0])
        else:
            if B.nbkeys == 2 * B.degree - 1:
                B = btree.BTree([], [B])
                split(B, 0)
            __insert0(B)
        return B
```

***Solution 5* (B-trees: Linear Representation – *5 points*)**

Specifications:

The function `btree2list(`B`)` returns the linear representation (of type `str`) of the B-tree B if not empty, the empty string otherwise.

```
1       def __tolinear(B):
2           '''
3           B is a nonempty tree
4           '''
5           s = "(<"
6           for i in range(B.nbkeys-1):          # keys
7               s += str(B.keys[i]) + ','
8           s += str(B.keys[-1]) + ">"
9
10          for child in B.children:             # children
11              s += __tolinear(child)
12          s += ')'
13          return s
14
15      def tolinear(B):
16          if B == None:
17              return ""
18          else:
19              return __tolinear(B)
```