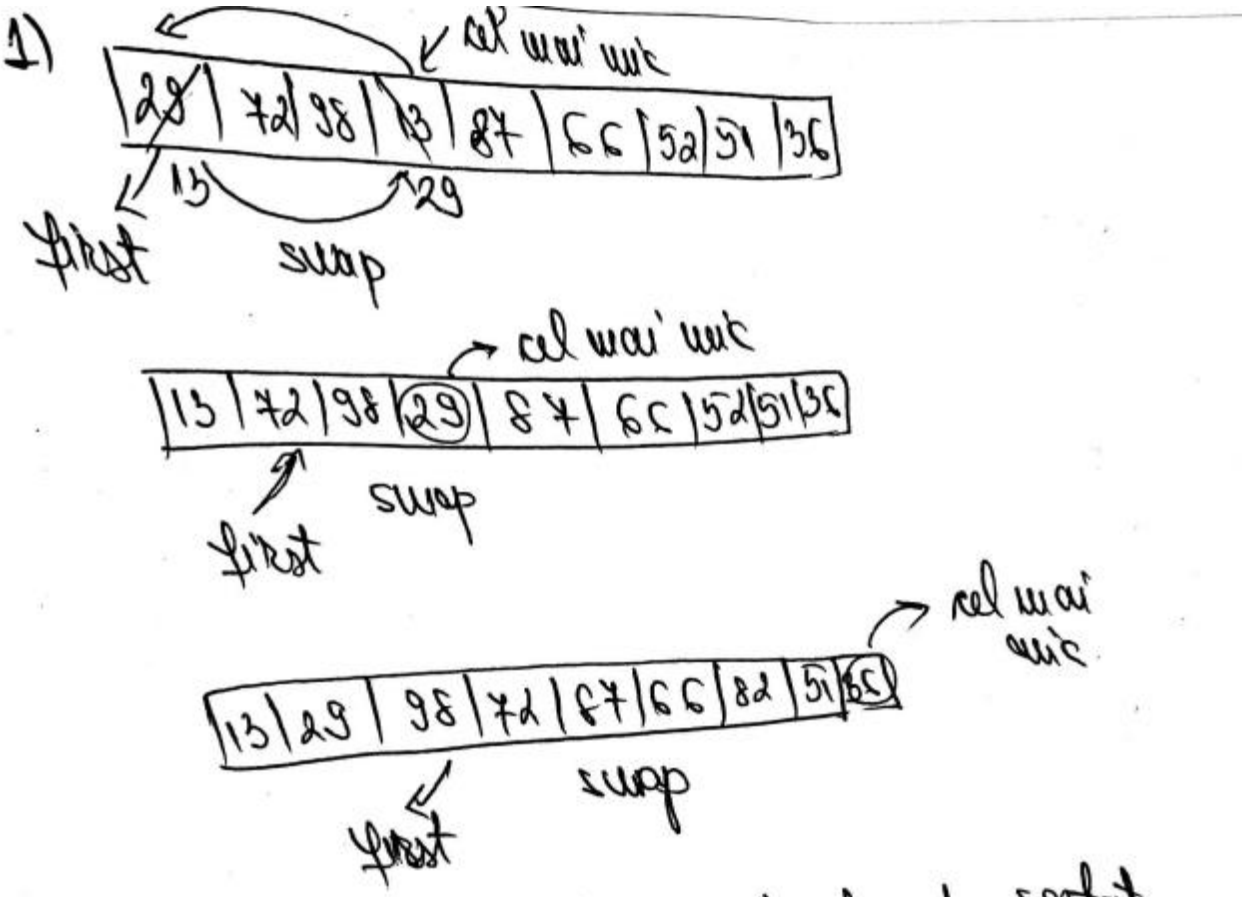
Vasile Stefania Elena

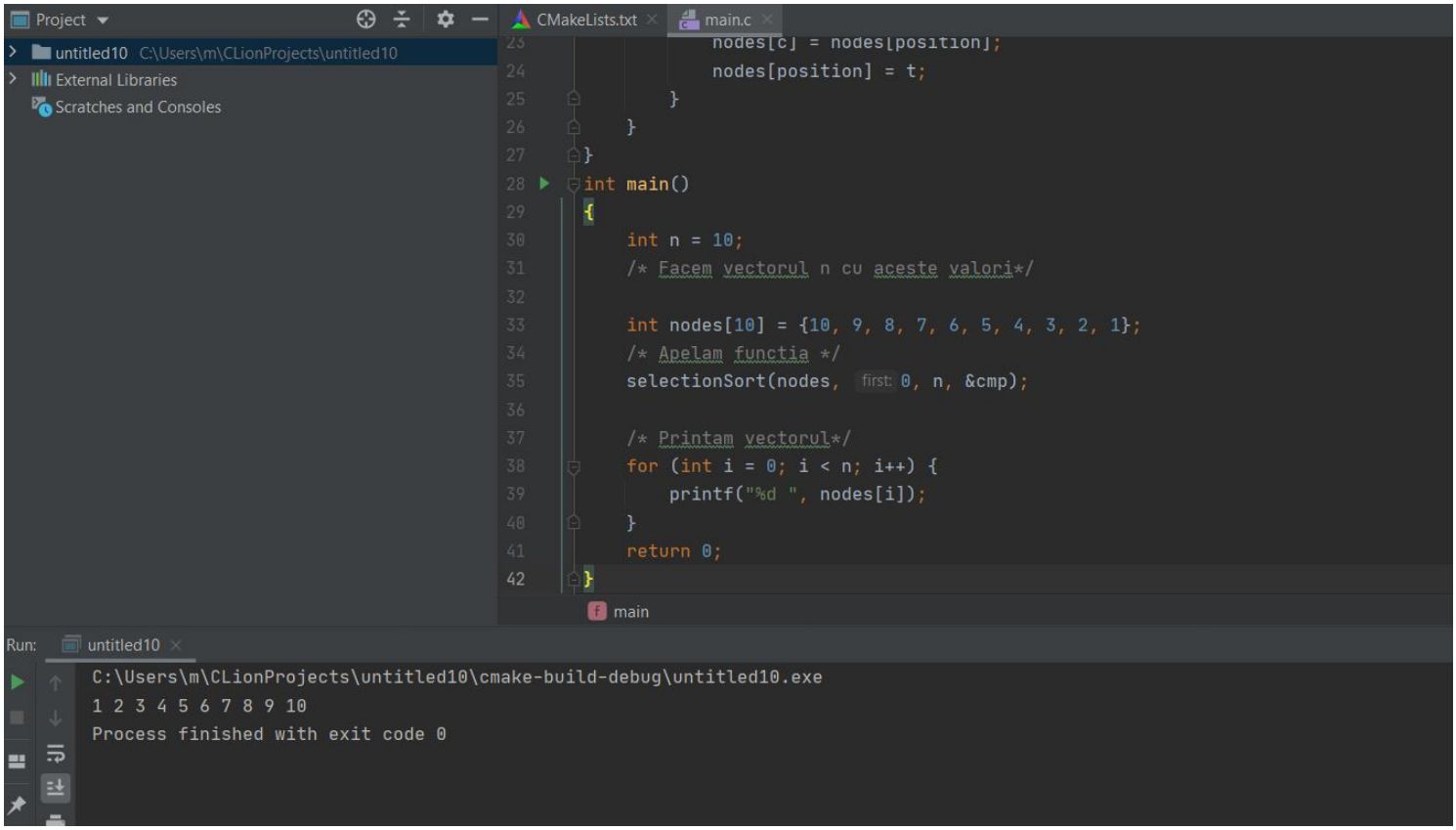
1a).

```
#include <stdio.h>


/* Comparator pentru selection sort*/
int cmp(int *a, int *b)
{
   return *a > *b;
}
void selectionSort(int nodes[], int first, int last, int (*cmp)(int * a, int* b))
{
   int position = 0, c = 0, d = 0;
   /* Cautam minimum n - 1 ori*/
   for (c = first; c < (last - 1); c++) {
      position = c;


      /* Luam mereu elementele din fata si le schimbam daca indeplinesc conditia */
      for (d = c + 1; d < last; d++) {
         if (cmp(&nodes[position], &nodes[d]))
            position = d;
      }
      /* Daca nu este elementul insusi, facem  swap cu elementul mai mic*/
      if (position != c) {
         int t = nodes[c];
         nodes[c] = nodes[position];
         nodes[position] = t;
      }
   }
}
int main()
{
   int n = 10;
```

```
    /* Facem vectorul n cu aceste valori*/


    int nodes[10] = {10, 9, 8, 7, 6, 5, 4, 3, 2, 1};

    /* Apelam functia */

    selectionSort(nodes, 0, n, &cmp);


    /* Printam vectorul*/

    for (int i = 0; i < n; i++) {

       printf("%d ", nodes[i]);

    }

    return 0;

}
```



Și tot așa până când vectorul este sortat.

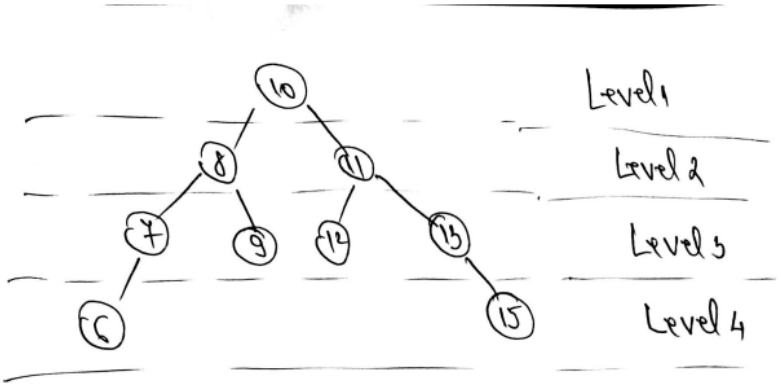

Project
untitled10 C:\Users\m\CLionProjects\untitled10
External Libraries
Scratches and Consoles
CMakeLists.txt
main.c
nodes[c] = nodes[position];
nodes[position] = t;
}
}
}
int main()
{
int n = 10;
/* Facem vectorul n cu aceste valori*/
int nodes[10] = {10, 9, 8, 7, 6, 5, 4, 3, 2, 1};
/* Apelam functia */
selectionSort(nodes, first: 0, n, &cmp);
/* Printam vectorul*/
for (int i = 0; i < n; i++) {
printf("%d ", nodes[i]);
}
return 0;
}
main
Run:
untitled10
C:\Users\m\CLionProjects\untitled10\cmake-build-debug\untitled10.exe
1 2 3 4 5 6 7 8 9 10
Process finished with exit code 0

1b).

```
#include <stdio.h>
#include <stdlib.h>

struct node_btree
{
   int data;
   struct node_btree* left, *right;
};

int get_height(struct node_btree* node)
{
   if (node == NULL)
      return 0;
   else {
      /* calculam inaltimea pe fiecare subarbore */
      int lheight = get_height(node->left);
      int rheight = get_height(node->right);

      /* Si trebuie sa o luam pe cel mai mare dintre cele 2 */
      if (lheight > rheight)
         return(lheight + 1);
      else return(rheight + 1);
   }
}
/* Functia aceasta printeaza elementele de pe nivelul curent */
void printLevel(struct node_btree* root, int level)
{
   /* Conditia de oprire */
   if (root == NULL)
```

```
    return;
  /* Am ajuns la final */
  if (level == 1)
    printf("%d ", root->data);
  else if (level > 1)
  {
    /* Recursivitate pe bratul stang si pe bratul drept */
    printLevel(root->left, level - 1);
    printLevel(root->right, level - 1);
  }
}

void tl_tree(struct node_btree* r)
{
  /* Luam inaltimea arborelui */
  int height = get_height(r);
  for (int i = 1; i <= height; i++)
    printLevel(r, i);
}

/* Functie cu care creem noduri pentru testare */
struct node_btree* newNode(int data)
{
  /* Creem nodul dinamic */
  struct node_btree* node = (struct node_btree*)
            malloc(sizeof(struct node_btree));
  /* Punem informatia in el dar si copii ii setam pe null deoarece
   * nu are copii in acel moment
   */
  node->data = data;
```

```
    node->left = NULL;
    node->right = NULL;

    return(node);
}
int main()
{
    struct node_btree *root = newNode(1);
    root->left        = newNode(2);
    root->right       = newNode(3);
    root->left->left  = newNode(4);
    root->left->right = newNode(5);

    printf("Parcurgerea in latime pe arbore este: \n");
    tl_tree(root);

    return 0;
}
```



Incep cu level 1; Afisam: 10
Level 2: 8, 11
Level 3: 7, 9, 12, 15
Level 4: 15

Se foloseste de recursivitate, cand terminam un subarbore se intoarce si se duce pe celalalt subarbore.

```c
    /* Punem informatia in el dar si copii ii setam pe null deoarece
     * nu are copii in acel moment
     */
    node->data = data;
    node->left = NULL;
    node->right = NULL;

    return(node);
}
int main()
{
    struct node_btree *root = newNode( data: 1);
    root->left        = newNode( data: 2);
    root->right       = newNode( data: 3);
    root->left->left  = newNode( data: 4);
    root->left->right = newNode( data: 5);

    printf("Parcurgerea in latime pe arbore este: \n");
    tl_tree(root);

    return 0;
}
```

```
C:\Users\m\CLionProjects\untitled11\cmake-build-debug\untitled11.exe
Parcurgerea in latime pe arbore este:
1 2 3 4 5
Process finished with exit code 0
```

2. #include <stdio.h>

#include <stdlib.h>

#include <math.h>

#define len(x) ((int)log10(x)+1)

/* Nodurile din arborele Huffman */

struct node{

   /* Valoarea */

   int value;

   /* Letter */

   char letter;

   /* Copii din stanga si din dreapta */

   struct node *left,*right;

};

typedef struct node Node;

/* 81 = 8.1%, 128 = 12.8% si asa mai departe. Cele 26 de litere sunt spatiul de encodare.*/

int romanianLetterFrequencies [26] = {81, 15, 28, 43, 128, 23, 20, 61, 71, 2, 1, 40, 24, 69, 76, 20, 1, 61, 64, 91, 28, 10, 24, 1, 20, 1};

/* Comparator pentru selection sort*/

int cmp(int *a, int *b)

{

   return *a > *b;

}

void selectionSort(int nodes[], int first, int last, int (*cmp)(int * a, int* b))

{

```
    int position = 0, c = 0, d = 0;
    /* Cautam minimum n - 1 ori*/
    for (c = first; c < (last - 1); c++) {
        position = c;

        /* Luam mereu elementele din fata si le schimbam daca indeplinesc conditia */
        for (d = c + 1; d < last; d++) {
            if (cmp(&nodes[position], &nodes[d]))
                position = d;
        }
        /* Daca nu este elementul insusi, facem  swap cu elementul mai mic*/
        if (position != c) {
            int t = nodes[c];
            nodes[c] = nodes[position];
            nodes[position] = t;
        }
    }
}

/*Cream arborele huffman si returnam adresa lui */
void buildHuffmanTree(Node **tree){
    Node *temp;
    Node *array[26];
    int i, subTrees = 26;
    int smallOne = 0,smallTwo = 0;
    /* Il folosim pentru sortare*/
    int array2[26] = {0};

    /* Alocam memorie pentru fiecare element din arborele huffman*/
    for (i = 0; i < 26; i++){
```

```
    array[i] = malloc(sizeof(Node));
    array[i]->value = romanianLetterFrequencies[i];
    array[i]->letter = i;
    array[i]->left = NULL;
    array[i]->right = NULL;
  }

  for (int i = 0; i < 26; i++)
    array2[i] = array[i]->value;

  selectionSort(array2, 0, 26, &cmp);
  while (subTrees > 1){
    /* Luam primele cele mai mici 2 valori*/
    smallOne=array2[0];
    smallTwo=array2[1];
    /* Retinem primul element*/
    temp = array[smallOne];
    /* Alocam memorie pentru elementul cel mai mic ****REINITIALIZARE***** pentru el sii copii lui*/
    array[smallOne] = malloc(sizeof(Node));
    array[smallOne]->value=temp->value+array[smallTwo]->value;
    array[smallOne]->letter=127;
    array[smallOne]->left=array[smallTwo];
    array[smallOne]->right=temp;
    /* Al doilea va deveni copil*/
    array[smallTwo]->value=-1;
    subTrees--;
  }
  /* Am creeat arborele*/
  *tree = array[smallOne];
}
```

```
int main()
{
   /* arborele nostru */
   Node *tree;
   /* il cream */
   buildHuffmanTree(&tree);
   return 0;
}
```