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Esanov Otabekning Dasturlash asoslari fanidan

Labaratoriya ishi

Mavzu: Qt visual dasturlash muhitida saralash algoritmlari

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Reja:

1. Saralash algoritmlarning turlari.
2. Qt muhitida saralash algoritmlari.
3. Natija va tahlil.
4. Xulosa.
5. Foydalanilgan adabiyotlar.

Saralash algoritmlarining turlari

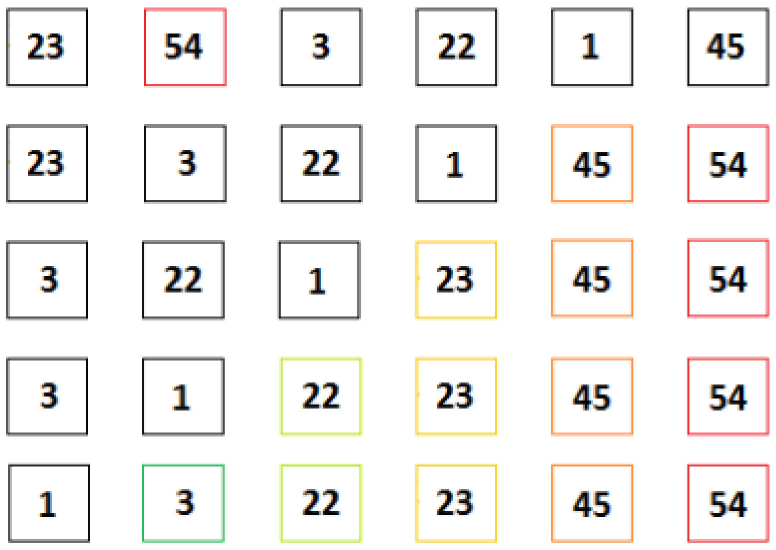
Saralash deb, berilgan obyektlar ketma-ketligini ma`lum mantiqiy tartibda qayta joylashtirish jarayoniga aytiladi. Saralash bir necha ko`rsatkichlarga bog`liq bo`lishi mumkin. Misol uchun maktab jismoniy tarbiya darsi. Bu dars boshida bolalar bo`ylariga qarab safda turishadi. Me`yor topshirish jarayonida esa sinf jurnalidagi familyalar ketma-ketligiga qarab topshirishadi. Shu yerning o`zida 2ta saralashdan foydalanilyapti. Biri, bo`y uzunligi bo`yicha, ikkinchisi sinf jurnalidagi o`rinlar bo`yicha.

Saralash jarayoni qanday kechadi? Saralash jarayoni taqqoslashga asoslangan jarayon hisoblanadi. Bu jarayonni his qilish uchun miyamizdagi tezlik bilan kechayotgan jarayonlarni birma-bir tahlil qilib chiqamiz(buning uchun saralanmagan sonlar ketma-ketligini olamiz):

Sonlar berilishi: 23, 54, 3, 22, 1, 45;

1. Eng kattasini boshiga o`tkazamiz: 23, 3, 22, 1, 45, 54;(54 soni har bir son bilan solishtirilib eng katta ekani aniqlandi, 45 esa o`z o`rnida turibdi)
2. Shu tartibni davom ettiramiz: 3, 22, 1, 23, 45, 54;(23 undan keyinda turuvchi eng katta son)
3. Yuqoridagi amalni yana davom ettiramiz: 3, 1, 22, 23, 45, 54;(22 esa davomchi)

4. Oxirgi marta almashtirishimiz quyidagi natijani beradi: 1, 3, 22, 23, 45, 54;(1 eng kichigi)



Demak, miyamiz xuddi shu jarayonni takrorlar ekan. Endi bizga ma`lumki, bizning miyamiz o`zi optimal deb bilgan yo`nalishdan ketadi va biz uchun faqat bitta saralash algoritmi mavjud. Ammo dasturlashda bunday deb bo`lmaydi. Dasturlashga talab ortib, bu soha rivojlanib borgani sari unda bir qator sohalardagi kabi tezlikni oshirish muammosi paydo bo`ladi. Chunki ilk kompyuter tizimlarida kompyuter tizimining 30% tezligi, operativ xotirasi saralashga sarflanar edi. Shu o`rinda savol tug`iladi, operatsion tizimlarda ham saralashdan foydalaniladimi? Albatta ha! Fikrimiz isbotini hozirda keng foydalaniladigan Total Commander dasturi isbotlaydi. Unda bir necha xil saralash mavjud: fayl turi, nomi, o`zgartirilgan sanasi va o`lchami. Har birini o`sish yoki kamayish tartibida saralash mumkin. Ha aytgancha, hozirgi tizimlar 30% emas anchagina kamroq tezlik va xotira sarflashadi. Chunki tezlik masalasi tobora yuqori cho`qqiga chiqayotgan va ishlanayotgan ma`lumotlar o`lchami oshib borayotgan bir paytda sekin ishlovchi algoritmlardan foydalanish kulguli. Ma`lumotlar o`lchamlari esa juda katta, shu sabali ularni aniq va tez saralashga ehtiyoj mavjud. Buni amalga oshirish uchun esa yangi algoritmlarga ehtiyoj tug`ila boshladi. Buni yechimi sifatida bir necha turdagi algoritmlardan foydalaniladi. Ular:

1. Bubble sort;
2. Selection sort;
3. Insertion sort;
4. Quick sort;
5. Merge sort.

Qt muhitida saralash algoritmlari.

Biz dasturimizda 6 ta saralash usulidan foydalanamiz:

Bular yuqorida ko’rsatilgan turlar va Qt muhitining standart qsort funksiyasidan.

1-ish. Saralash algorimlarimizni bitta methodlar to’plamiga ega “algoritmlar.h” kutubxonasiga yozib olamiz.

```
#ifndef ALGORITMLAR
#define ALGORITMLAR
#include <bits/stdc++.h>


//almashtirish funksiyasi
void swap(int *xp, int *yp)
{
    int temp = *xp;
    *xp = *yp;
    *yp = temp;
}

//quickSort - tez saralash algoritmi
void quickSort(int *arr, int low, int high)
{
    int i = low;
    int j = high;
    int pivot = arr[(i + j) / 2];
    int temp;

    while (i <= j)
    {
        while (arr[i] < pivot)
            i++;
        while (arr[j] > pivot)
            j--;
        if (i <= j)
        {
            temp = arr[i];
            arr[i] = arr[j];
            arr[j] = temp;
            i++;
            j--;
        }
    }
    if (j > low)
        quickSort(arr, low, j);
    if (i < high)
```

```
        quickSort(arr, i, high);
}


// bubbleSort - pufakchali saralash algoritmi
void bubbleSort(int arr[], int n)
{
    int i, j;
    for (i = 0; i < n-1; i++)
    for (j = 0; j < n-i-1; j++)
        if (arr[j] > arr[j+1])
            swap(&arr[j], &arr[j+1]);
}

// merge - mergeSort algoritmini qism dasturi
void merge(int arr[], int l, int m, int r)
{
    int n1 = m - l + 1;
    int n2 = r - m;

    int L[n1], R[n2];

    for (int i = 0; i < n1; i++)
        L[i] = arr[l + i];
    for (int j = 0; j < n2; j++)
        R[j] = arr[m + 1 + j];

    int i = 0;

    int j = 0;

    int k = l;

    while (i < n1 && j < n2) {
        if (L[i] <= R[j]) {
            arr[k] = L[i];
            i++;
        }
        else {
            arr[k] = R[j];
            j++;
        }
        k++;
    }

    while (i < n1) {
        arr[k] = L[i];
        i++;
        k++;
    }
    while (j < n2) {
        arr[k] = R[j];
        j++;
        k++;
    }
}

// mergeSort - saralash algoritmi
void mergeSort(int arr[],int l,int r){
    if(l>=r){
        return;
    }
    int m =l+ (r-l)/2;
    mergeSort(arr,l,m);
    mergeSort(arr,m+1,r);
    merge(arr,l,m,r);
}

// selectionSort - tanlash orqali saralash algoritmi
void selectionSort(int arr[], int n)
{
    int i, j, min_idx;

    for (i = 0; i < n-1; i++)
    {
        min_idx = i;
        for (j = i+1; j < n; j++)
        if (arr[j] < arr[min_idx])
            min_idx = j;

        swap(&arr[min_idx], &arr[i]);
    }
}


// insertionSort -  saralash algoritmi
void insertionSort(int arr[], int n)
{
    int i, key, j;
    for (i = 1; i < n; i++)
    {
        key = arr[i];
        j = i - 1;

        while (j >= 0 && arr[j] > key)
        {
            arr[j + 1] = arr[j];
            j = j - 1;
        }
        arr[j + 1] = key;
    }
```

```
}


#endif // ALGORITMLAR
```

2-ish. Dasturimizning asosiy qismini yozib olamiz:

```
#include "mainwindow.h"
#include "ui_mainwindow.h"
#include <QMessageBox>
#include <algoritmlar.h>
#include <QDateTime>
#include <QtAlgorithms>
using namespace std;
int arr[100000],brr[100000];

MainWindow::MainWindow(QWidget *parent) :
    QMainWindow(parent),
    ui(new Ui::MainWindow)
{
    ui->setupUi(this);
}

MainWindow::~MainWindow()
{
    delete ui;
}

void MainWindow::on_pushButton_6_clicked()
{
    ui->listWidget->clear();
    for(int i=0;i<100000;i++){
        arr[i]=rand()%100000;
        brr[i]=arr[i];
        ui->listWidget->addItem(QString::number(arr[i]));
    }

}

void MainWindow::on_pushButton_4_clicked()
{
    QMessageBox msg;
    msg.setWindowTitle("Tozalash");
    msg.setText("Sonlarni tozalashni xohlaysizmi?");
    msg.setStandardButtons(QMessageBox::Ok|QMessageBox::Cancel);
    int ret=msg.exec();

    switch(ret){
        case QMessageBox::Ok:
            ui->listWidget->clear();
            break;
        default:
            break;
    }
}

void MainWindow::on_pushButton_5_clicked()
{
    QMessageBox msg;
    msg.setWindowTitle("Chiqish");
    msg.setText("Dasturdan chiqishni xohlaysizmi?");
    msg.setStandardButtons(QMessageBox::Ok|QMessageBox::Cancel);
    int ret=msg.exec();

    switch(ret){
        case QMessageBox::Ok:
            this->close();
            break;
        default:
            break;
    }
}


void MainWindow::on_pushButton_clicked()
{
    QDateTime t_start=QDateTime::currentDateTime();
    QDateTime t_end;
    quickSort(arr, 0, 100000);
    t_end=QDateTime::currentDateTime();
    ui->listWidget->clear();
    for(int i=0;i<100000;i++){
        ui->listWidget->addItem(QString::number(arr[i]));
    }
    qint64 ms = t_start.msecsTo(t_end);
    ui->label_4->setText(QString::number(ms)+" milliseconds");
}

void MainWindow::on_pushButton_2_clicked()
{
    QDateTime t_start=QDateTime::currentDateTime();
    QDateTime t_end;

    bubbleSort(arr, 100000);
    t_end=QDateTime::currentDateTime();
    ui->listWidget->clear();
    for(int i=0;i<100000;i++){
        ui->listWidget->addItem(QString::number(arr[i]));
    }
    qint64 ms = t_start.msecsTo(t_end);
    ui->label_5->setText(QString::number(ms)+" milliseconds");
}

void MainWindow::on_pushButton_3_clicked()
{
    QDateTime t_start=QDateTime::currentDateTime();
    QDateTime t_end;

    mergeSort(arr, 0, 100000);
    t_end=QDateTime::currentDateTime();
    ui->listWidget->clear();
    for(int i=0;i<100000;i++){
        ui->listWidget->addItem(QString::number(arr[i]));
    }

    qint64 ms = t_start.msecsTo(t_end);
    ui->label_6->setText(QString::number(ms)+" milliseconds");
}

void MainWindow::on_pushButton_7_clicked()
{
    QDateTime t_start=QDateTime::currentDateTime();
    QDateTime t_end;

    qSort(arr,arr+100000);
    t_end=QDateTime::currentDateTime();
    ui->listWidget->clear();
    for(int i=0;i<100000;i++){
        ui->listWidget->addItem(QString::number(arr[i]));
    }

    qint64 ms = t_start.msecsTo(t_end);
    ui->label_8->setText(QString::number(ms)+" milliseconds");
}

void MainWindow::on_pushButton_8_clicked()
{
    QDateTime t_start=QDateTime::currentDateTime();
    QDateTime t_end;

    selectionSort(arr,100000);
    t_end=QDateTime::currentDateTime();
    ui->listWidget->clear();
    for(int i=0;i<100000;i++){
        ui->listWidget->addItem(QString::number(arr[i]));
    }

    qint64 ms = t_start.msecsTo(t_end);
    ui->label_10->setText(QString::number(ms)+" milliseconds");
```

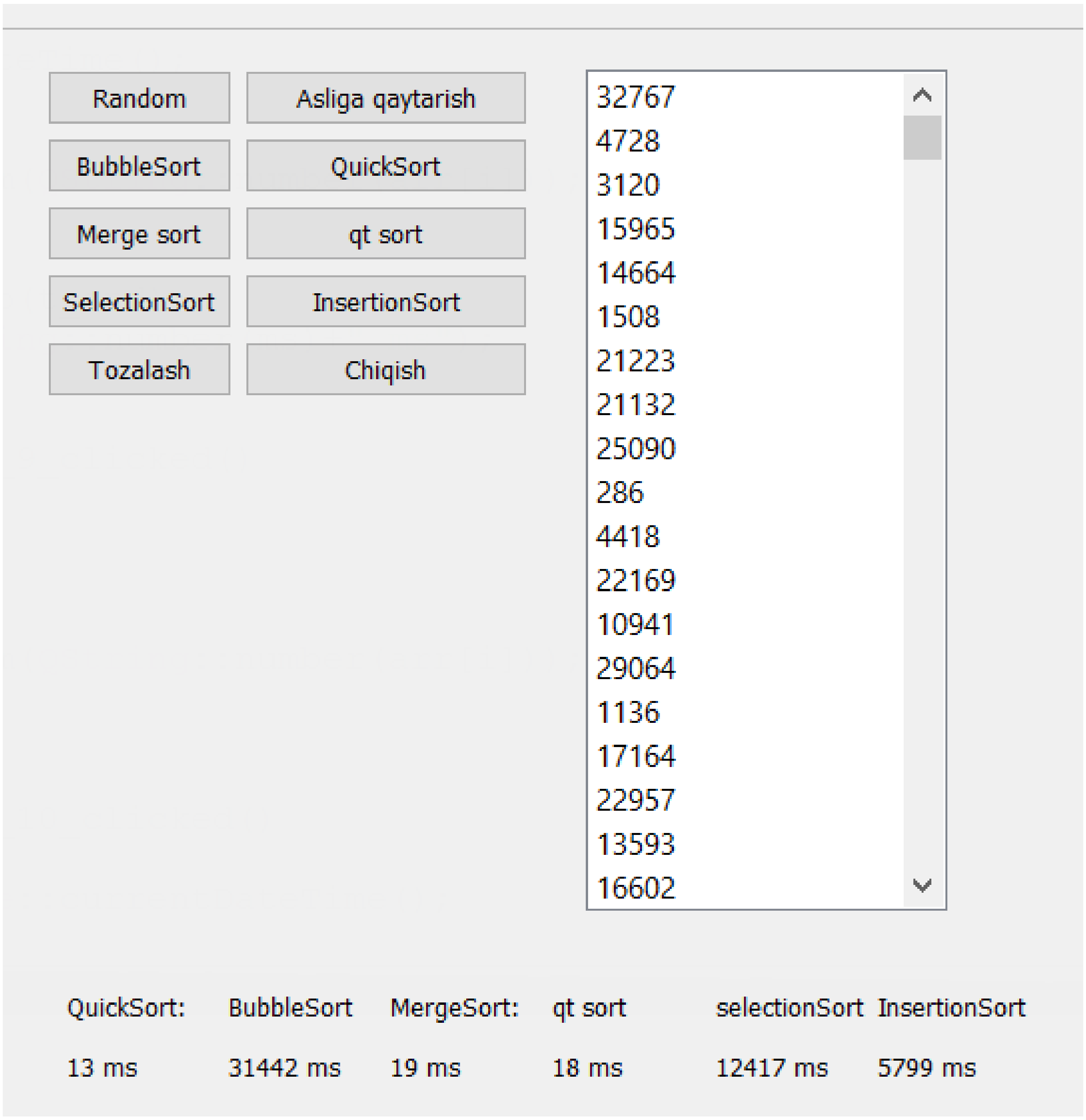
```
}

void MainWindow::on_pushButton_9_clicked()
{
    ui->listWidget->clear();
    for(int i=0;i<100000;i++){
        arr[i]=brr[i];
        ui->listWidget->addItem(QString::number(arr[i]));
    }
}

void MainWindow::on_pushButton_10_clicked()
{
    QDateTime t_start=QDateTime::currentDateTime();
    QDateTime t_end;

    insertionSort(arr,100000);
    t_end=QDateTime::currentDateTime();
    ui->listWidget->clear();
    for(int i=0;i<100000;i++){
        ui->listWidget->addItem(QString::number(arr[i]));
    }

    qint64 ms = t_start.msecsTo(t_end);
    ui->label_12->setText(QString::number(ms)+" milliseconds");
}
```

3-ish. Bu yerda saralash algoritmlarini qancha vaqtda ishlashini ko‘rsatib beruvchi kod:

```
QDateTime t_start=QDateTime::currentDateTime(); //saralash
boshlanmasdan oldingi vaqt
QDateTime t_end;

// Saralash algoritmi

t_end=QDateTime::currentDateTime(); //saralash tugagandan keying
vaqtni oluvchi kod

qint64 ms = t_start.msecsTo(t_end); // ikkala vaqtni orasidagi
farqni millisekundlarda olamiz.
```

Natija va tahlil.

Biz 10^5 ta sonlarni 6 ta saralsh usuliga qo’yib ko’rdik.



```
32767
4728
3120
15965
14664
1508
21223
21132
25090
286
4418
22169
10941
29064
1136
17164
22957
13593
16602
```

```
QuickSort:   BubbleSort   MergeSort:   qt sort    selectionSort  InsertionSort

13 ms        31442 ms     19 ms        18 ms      12417 ms       5799 ms
```

Biz ishlatgan 6 ta saralash usulini natijalari:

Saralash algoritmi	**Vaqti: millisekundlarda**
QuickSort	13
BubbleSort	31442
MergeSort	19
QT muhitidagi qsort funksiyasi	18
SelectionSort	12417
InsertionSort	5799

Bu saralash usullaridan eng yaxshi ko’rtsatgichni o’z nomi bilan QuickSort (Tez saralash) algoritmi eng yaxshi ko’rsatkichni ko’rsatdi. MergeSort va sort funksiyalari ham ancha yaxshi saralab berdi. BubbleSort, SelectionSort va InsertionSort usullari anchagina sekin ishladi.

Xulosa:

Saralash algoritmlarining juda ham ko’p turlari bor, biz atigi 5 tasini ko’rib ketdik. Ammo bularning ichidan eng yaxshi natijani ko’rsatadiganlari O(nlogn) vaqtda saralaydi bundan optimallari hali mavjud emas. Ba’zilari esa xususiy hollar uchungiana yaxshi natijani ko’rsatadi. Bular ichidan hozircha eng yaxshi deb topilganlari QuickSort va MergeSort saralash algoritmlaridir.

Foydalanilgan adabiyotlar:

1. https://www.texnoman.uz
2. https://www.geeksforgeeks.org