Лабораторная работа № 3

Иллюстрация сортировки методом Quick Sort

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* | *10* | *11* | *12* | *13* | *14* | *15* |
| **7** | **3** | **6** | **0** | **5** | **8** | **23** | **11** | **15** | **-4** | **12** | **9** | **20** | **17** | **1** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **X** | **L** | **R** | **i** | **j** | **S** | **St** |
| **11** | **1** | **15** | **1** | **15** | **0** | **(1,15)** |

X=mass[(L+R) div 2]

1. Swap (mass[7]),mass[15])

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* | *10* | *11* | *12* | *13* | *14* | *15* |
| **7** | **3** | **6** | **0** | **5** | **8** | **1** | **11** | **15** | **-4** | **12** | **9** | **20** | **17** | **23** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **X** | **L** | **R** | **i** | **j** | **S** | **St** |
| **11** | **1** | **15** | **8** | **14** | **0** | **(1,15)** |

1. Swap (mass[8],mass[12])

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* | *10* | *11* | *12* | *13* | *14* | *15* |
| **7** | **3** | **6** | **0** | **5** | **8** | **1** | **9** | **15** | **-4** | **12** | **11** | **20** | **17** | **23** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **X** | **L** | **R** | **i** | **j** | **S** | **St** |
| **11** | **1** | **15** | **9** | **11** | **0** | **(1,15)** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **X** | **L** | **R** | **i** | **j** | **S** | **St** |
| **11** | **1** | **15** | **10** | **9** | **0** | **(1,15)** |

1. Swap (mass[9],mass[10])

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* | *10* | *11* | *12* | *13* | *14* | *15* |
| **7** | **3** | **6** | **0** | **5** | **8** | **1** | **9** | **-4** | **15** | **12** | **11** | **20** | **17** | **23** |

1. I>j - остановка перестановок;

I<R - разбить на подмассивы: (1, 9) и (10, 15);

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **X** | **L** | **R** | **i** | **j** | **S** | **St** |
| **5** | **1** | **9** | **1** | **9** | **1** | **(10,15)** |

L<R – не достаем из стека;

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* | *10* | *11* | *12* | *13* | *14* | *15* |
| **7** | **3** | **6** | **0** | **5** | **8** | **1** | **9** | **-4** | **15** | **12** | **11** | **20** | **17** | **23** |

1. Swap(mass[1],mass[9])

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* | *10* | *11* | *12* | *13* | *14* | *15* |
| **-4** | **3** | **6** | **0** | **5** | **8** | **1** | **9** | **7** | **15** | **12** | **11** | **20** | **17** | **23** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **X** | **L** | **R** | **i** | **j** | **S** | **St** |
| **5** | **1** | **9** | **2** | **8** | **1** | **(10,15)** |

1. Swap(mass[3],mass[7])

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* | *10* | *11* | *12* | *13* | *14* | *15* |
| **-4** | **3** | **1** | **0** | **5** | **8** | **6** | **9** | **7** | **15** | **12** | **11** | **20** | **17** | **23** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **X** | **L** | **R** | **i** | **j** | **S** | **St** |
| **5** | **1** | **9** | **4** | **6** | **1** | **(10,15)** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **X** | **L** | **R** | **i** | **j** | **S** | **St** |
| **5** | **1** | **9** | **6** | **4** | **1** | **(10,15)** |

1. Swap(mass[5],mass[5])

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* | *10* | *11* | *12* | *13* | *14* | *15* |
| **-4** | **3** | **1** | **0** | **5** | **8** | **6** | **9** | **7** | **15** | **12** | **11** | **20** | **17** | **23** |

1. I>j - остановка перестановок;

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **X** | **L** | **R** | **i** | **j** | **S** | **St** |
| **3** | **1** | **4** | **1** | **4** | **2** | **(6, 9)**  **(10,15)** |

I<R - разбить на подмассивы: (1, 4) , отсортированный элемент 5, (6, 9) и (10,15);

L<R – не достаем из стека;

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* | *10* | *11* | *12* | *13* | *14* | *15* |
| **-4** | **3** | **1** | **0** | **5** | **8** | **6** | **9** | **7** | **15** | **12** | **11** | **20** | **17** | **23** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **X** | **L** | **R** | **i** | **j** | **S** | **St** |
| **3** | **1** | **4** | **3** | **3** | **2** | **(6, 9)**  **(10,15)** |

1. Swap(mass[2],mass[4])

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* | *10* | *11* | *12* | *13* | *14* | *15* |
| **-4** | **0** | **1** | **3** | **5** | **8** | **6** | **9** | **7** | **15** | **12** | **11** | **20** | **17** | **23** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **X** | **L** | **R** | **i** | **j** | **S** | **St** |
| **3** | **1** | **4** | **4** | **3** | **2** | **(6, 9)**  **(10,15)** |

1. I>j - остановка перестановок;

I=R – нет разбития на подмассивы;

L<R – не достаем из стека

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* | *10* | *11* | *12* | *13* | *14* | *15* |
| **-4** | **0** | **1** | **3** | **5** | **8** | **6** | **9** | **7** | **15** | **12** | **11** | **20** | **17** | **23** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **X** | **L** | **R** | **i** | **j** | **S** | **St** |
| **0** | **1** | **3** | **1** | **3** | **2** | **(6, 9)**  **(10,15)** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **X** | **L** | **R** | **i** | **j** | **S** | **St** |
| **0** | **1** | **3** | **3** | **1** | **2** | **(6, 9)**  **(10,15)** |

1. Swap(mass[2],mass[2])

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* | *10* | *11* | *12* | *13* | *14* | *15* |
| **-4** | **0** | **1** | **3** | **5** | **8** | **6** | **9** | **7** | **15** | **12** | **11** | **20** | **17** | **23** |

1. I>j - остановка перестановок;

I=R – нет разбития на подмассивы;

L=R – достаем верхнее значение из стека;

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* | *10* | *11* | *12* | *13* | *14* | *15* |
| **-4** | **0** | **1** | **3** | **5** | **8** | **6** | **9** | **7** | **15** | **12** | **11** | **20** | **17** | **23** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **X** | **L** | **R** | **i** | **j** | **S** | **St** |
| **6** | **6** | **9** | **6** | **9** | **1** | **(10,15)** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **X** | **L** | **R** | **i** | **j** | **S** | **St** |
| **6** | **6** | **9** | **7** | **6** | **1** | **(10,15)** |

1. Swap(mass[6],mass[7])

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* | *10* | *11* | *12* | *13* | *14* | *15* |
| **-4** | **0** | **1** | **3** | **5** | **6** | **8** | **9** | **7** | **15** | **12** | **11** | **20** | **17** | **23** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **X** | **L** | **R** | **i** | **j** | **S** | **St** |
| **6** | **6** | **6** | **7** | **6** | **2** | **(7, 9)**  **(10,15)** |

1. I>j - остановка перестановок;

I<R – разбиваем на подмассивы;

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **X** | **L** | **R** | **i** | **j** | **S** | **St** |
| **9** | **7** | **9** | **7** | **9** | **1** | **(10,15)** |

L=R – достаем верхнее значение из стека;

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* | *10* | *11* | *12* | *13* | *14* | *15* |
| **-4** | **0** | **1** | **3** | **5** | **6** | **8** | **9** | **7** | **15** | **12** | **11** | **20** | **17** | **23** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **X** | **L** | **R** | **i** | **j** | **S** | **St** |
| **9** | **7** | **9** | **9** | **8** | **1** | **(10,15)** |

1. Swap(mass[8],mass[9])

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* | *10* | *11* | *12* | *13* | *14* | *15* |
| **-4** | **0** | **1** | **3** | **5** | **6** | **8** | **7** | **9** | **15** | **12** | **11** | **20** | **17** | **23** |

1. I>j - остановка перестановок;

I=R – нет разбития на подмассивы;

L<R – не достаем из стека;

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* | *10* | *11* | *12* | *13* | *14* | *15* |
| **-4** | **0** | **1** | **3** | **5** | **6** | **8** | **7** | **9** | **15** | **12** | **11** | **20** | **17** | **23** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **X** | **L** | **R** | **i** | **j** | **S** | **St** |
| **8** | **7** | **8** | **7** | **8** | **1** | **(10,15)** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **X** | **L** | **R** | **i** | **j** | **S** | **St** |
| **8** | **7** | **8** | **8** | **7** | **1** | **(10,15)** |

1. Swap(mass[7],mass[8])

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* | *10* | *11* | *12* | *13* | *14* | *15* |
| **-4** | **0** | **1** | **3** | **5** | **6** | **7** | **8** | **9** | **15** | **12** | **11** | **20** | **17** | **23** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **X** | **L** | **R** | **i** | **j** | **S** | **St** |
| **8** | **7** | **7** | **8** | **7** | **1** | **(10,15)** |

1. I>j - остановка перестановок;

I=R – нет разбития на подмассивы;

L=R – достаем верхнее значение из стека;

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* | *10* | *11* | *12* | *13* | *14* | *15* |
| **-4** | **0** | **1** | **3** | **5** | **6** | **7** | **8** | **9** | **15** | **12** | **11** | **20** | **17** | **23** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **X** | **L** | **R** | **i** | **j** | **S** | **St** |
| **11** | **10** | **15** | **10** | **15** | **0** | **(,)** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **X** | **L** | **R** | **i** | **j** | **S** | **St** |
| **11** | **10** | **15** | **11** | **11** | **0** | **(,)** |

1. Swap(mass[10],mass[12])

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* | *10* | *11* | *12* | *13* | *14* | *15* |
| **-4** | **0** | **1** | **3** | **5** | **6** | **7** | **8** | **9** | **11** | **12** | **15** | **20** | **17** | **23** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **X** | **L** | **R** | **i** | **j** | **S** | **St** |
| **11** | **10** | **10** | **11** | **10** | **1** | **(11,15)** |

1. I>j - остановка перестановок;

I<R – разбиваем на подмассивы;

L=R – достаем верхнее значение из стека;

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* | *10* | *11* | *12* | *13* | *14* | *15* |
| **-4** | **0** | **1** | **3** | **5** | **6** | **7** | **8** | **9** | **11** | **12** | **15** | **20** | **17** | **23** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **X** | **L** | **R** | **i** | **j** | **S** | **St** |
| **20** | **11** | **15** | **11** | **15** | **0** | **(,)** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **X** | **L** | **R** | **i** | **j** | **S** | **St** |
| **20** | **11** | **15** | **14** | **13** | **0** | **(,)** |

1. Swap(mass[13],mass[14])

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* | *10* | *11* | *12* | *13* | *14* | *15* |
| **-4** | **0** | **1** | **3** | **5** | **6** | **7** | **8** | **9** | **11** | **12** | **15** | **17** | **20** | **23** |

1. I>j - остановка перестановок;

I<R – разбиваем на подмассивы;

L<R – не достаем из стека;

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* | *10* | *11* | *12* | *13* | *14* | *15* |
| **-4** | **0** | **1** | **3** | **5** | **6** | **7** | **8** | **9** | **11** | **12** | **15** | **17** | **20** | **23** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **X** | **L** | **R** | **i** | **j** | **S** | **St** |
| **15** | **11** | **13** | **11** | **13** | **1** | **(14,15)** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **X** | **L** | **R** | **i** | **j** | **S** | **St** |
| **15** | **11** | **13** | **13** | **11** | **1** | **(14,15)** |

1. Swap(mass[12],mass[12])

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* | *10* | *11* | *12* | *13* | *14* | *15* |
| **-4** | **0** | **1** | **3** | **5** | **6** | **7** | **8** | **9** | **11** | **12** | **15** | **17** | **20** | **23** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **X** | **L** | **R** | **i** | **j** | **S** | **St** |
| **15** | **11** | **11** | **13** | **11** | **0** | **(,)** |

1. I>j - остановка перестановок;

I=R – не разбиваем на подмассивы;

L=R – не достаем из стека;

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* | *10* | *11* | *12* | *13* | *14* | *15* |
| **-4** | **0** | **1** | **3** | **5** | **6** | **7** | **8** | **9** | **11** | **12** | **15** | **17** | **20** | **23** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **X** | **L** | **R** | **i** | **j** | **S** | **St** |
| **20** | **14** | **15** | **14** | **15** | **0** | **(,)** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **X** | **L** | **R** | **i** | **j** | **S** | **St** |
| **20** | **14** | **15** | **15** | **13** | **0** | **(,)** |

1. Swap(mass[14],mass[14])

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* | *10* | *11* | *12* | *13* | *14* | *15* |
| **-4** | **0** | **1** | **3** | **5** | **6** | **7** | **8** | **9** | **11** | **12** | **15** | **17** | **20** | **23** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **X** | **L** | **R** | **i** | **j** | **S** | **St** |
| **20** | **14** | **13** | **15** | **13** | **0** | **(,)** |

1. I>j - остановка перестановок;

I=R – не разбиваем на подмассивы;

L>R – не достаем из стека;

S=0 – сортировка завершена.

Отсортированный массив:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* | *10* | *11* | *12* | *13* | *14* | *15* |
| **-4** | **0** | **1** | **3** | **5** | **6** | **7** | **8** | **9** | **11** | **12** | **15** | **17** | **20** | **23** |