CSC6013 - Worksheet for Week 6

Russian Peasants Multiplication

1. Trace the Russian Peasants Multiplication algorithm for the following products.

Show each recursive call and the final result, as shown in the live session (table).

* 1. 64 \* 13
  2. 60 \* 13
  3. 59 \* 13

**Problem A - 64 \* 13**

|  |  |  |
| --- | --- | --- |
| **n** | **m** | **Steps** |
| 64 | 13 | 64 is even |
| 32 | 26 | 32 is even |
| 16 | 52 | 16 is even |
| 8 | 104 | 8 is even |
| 4 | 208 | 4 is even |
| 2 | 416 | 2 is even |
| 1 | 832 | **832** |

**Problem B - 60 \* 13**

|  |  |  |
| --- | --- | --- |
| **n** | **m** | **Steps** |
| 60 | 13 | 60 is even |
| 30 | 26 | 30 is even |
| 15 | 52 | 15 is odd (+52) |
| 7 | 104 | 7 is odd (+104) |
| 3 | 208 | 3 is odd (+208) |
| 1 | 416 | 416+52+104+208 = **322** |

**Problem c - 59 \* 13**

|  |  |  |
| --- | --- | --- |
| **n** | **m** | **Steps** |
| 59 | 13 | 59 is odd (+13) |
| 29 | 26 | 29 is odd (+26) |
| 14 | 52 | 14 is even |
| 7 | 104 | 7 is odd (+104) |
| 3 | 208 | 3 is odd (+208) |
| 1 | 416 | 416+13+26+104+208 = **767** |

Lomuto partition

1. Trace the Lomuto partition with the array:
   1. A = [100, 33, 22, 213, 65, 29, 153, 199, 47, 181, 85]

Using A[10] = 85 as pivot the final array will be:

● A = [33, 22, 65, 29, 47, 85, 153, 199, 100, 181, 213]

In your trace, write down to each change in either ***i*** or ***j***, stating: the values of ***i*** and ***j***, swaps made, and elements divided into lesser than the pivot, greater than the pivot, and yet to compare.

**Step 1:**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 100 | 33 | 22 | 213 | 65 | 29 | 153 | 199 | 47 | 181 | 85 |

i j

i = 0, j = 0

**Step 2:**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 100 | 33 | 22 | 213 | 65 | 29 | 153 | 199 | 47 | 181 | 85 |

i j

i = 0, j = 0 🡪 i = 0, j = 1

**Step 3:**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 33 | 100 | 22 | 213 | 65 | 29 | 153 | 199 | 47 | 181 | 85 |

i j

swap 100 and 33

i = 0, j = 1 🡪 i = 1, j = 2

**Step 4:**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 33 | 22 | 100 | 213 | 65 | 29 | 153 | 199 | 47 | 181 | 85 |

i j

swap 100 and 22

i = 1, j = 2 🡪 i = 2, j = 3

**Step 5:**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 33 | 22 | 100 | 213 | 65 | 29 | 153 | 199 | 47 | 181 | 85 |

i j

i = 2, j = 3🡪 i = 2, j = 4

**Step 6:**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 33 | 22 | 65 | 213 | 100 | 29 | 153 | 199 | 47 | 181 | 85 |

i j

swap 100 and 65

i = 2, j = 4 🡪 i = 3, j = 5

**Step 7:**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 33 | 22 | 65 | 29 | 100 | 213 | 153 | 199 | 47 | 181 | 85 |

i j

swap 213 and 29

i = 3, j = 5🡪 i = 4, j = 6

**Step 8:**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 33 | 22 | 65 | 29 | 100 | 213 | 153 | 199 | 47 | 181 | 85 |

i j

i = 4, j = 6🡪 i = 4, j = 7

**Step 9:**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 33 | 22 | 65 | 29 | 100 | 213 | 153 | 199 | 47 | 181 | 85 |

i j

i = 4, j = 7🡪 i = 4, j = 8

**Step 10:**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 33 | 22 | 65 | 29 | 47 | 213 | 153 | 199 | 100 | 181 | 85 |

i j

swap 100 with 47

i = 4, j = 8🡪 i = 5, j = 9

**Step 11:**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 33 | 22 | 65 | 29 | 47 | 213 | 153 | 199 | 100 | 181 | 85 |

i j

i = 5, j = 9🡪 i = 5, j = 10

**Step 12:**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 33 | 22 | 65 | 29 | 47 | 85 | 153 | 199 | 100 | 181 | 213 |

i j

Swap 213 and 85

i = 4, j = 7🡪 i = 5, j = 10