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	UO:294039	22/02/2024	2
	Surname: Rodriguez		
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Activity 1. Direct exchange or Bubble algorithm

n	T ordered	T reverse	T random
10000	1447	1904	1338
2*10000	4226	8993	5687
2**2*10000	8755	32710	23637
2**3*10000	38873	Oot	Oot
2**4*10000	Oot	Oot	Oot

Theoretical values of T ordered:

The complexity of T ordered is n^2. To know if the times we have obtain agree with the theoretical ones, we are going to calculate the theoretical times using the following formula:

$$t2 = \frac{n2^2}{n1^2} \cdot t1$$

1. For n1 = 10000 and n2 = 2*10000

$$t2 = \frac{20000^2}{10000^2} \cdot 1447 = 5788$$

2. For n1 = 2*10000 and n2 = 2**2*10000

$$t2 = \frac{40000^2}{20000^2} \cdot 4226 = 16904$$

3. For n1 = 2**2*10000 and n2 = 2**3*10000

$$t2 = \frac{80000^2}{40000^2} \cdot 8755 = 35020$$

After calculating the theoretical values, we can see that they are very similar to the experimental ones. So, the times we have obtained agree with the ones that were expected.

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Theoretical values of T reverse:

The complexity of T ordered is n^2. To know if the times we have obtain agree with the theoretical ones, we are going to calculate the theoretical times using the following formula:

$$t2 = \frac{n2^2}{n1^2} \cdot t1$$

1. For n1 = 10000 and n2 = 2*10000

$$t2 = \frac{20000^2}{10000^2} \cdot 1904 = 7616$$

2. For n1 = 2*10000 and n2 = 2**2*10000

$$t2 = \frac{40000^2}{20000^2} \cdot 8993 = 35972$$

After calculating the theoretical values, we can see that they are very similar to the experimental ones. So, the times we have obtained agree with the ones that were expected

Theoretical values of T random:

The complexity of T ordered is n^2. To know if the times we have obtain agree with the theoretical ones, we are going to calculate the theoretical times using the following formula:

$$t2 = \frac{n2^2}{n1^2} \cdot t1$$

1. For n1 = 10000 and n2 = 2*10000

$$t2 = \frac{20000^2}{10000^2} \cdot 1338 = 5352$$

2. For n1 = 2*10000 and n2 = 2**2*10000

$$t2 = \frac{40000^2}{20000^2} \cdot 5687 = 22748$$

After calculating the theoretical values, we can see that they are very similar to the experimental ones. So, the times we have obtained agree with the ones that were expected

Activity 2. Selection algorithm

n	T ordered	T reverse	T random
10000	491	595	479

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2*10000	2030	2341	2021
2**2*10000	8794	8631	8591
2**3*10000	34820	36108	34055
2**4*10000	Oot	Oot	Oot

Theoretical values of T ordered:

The complexity of T ordered is n^2. To know if the times we have obtain agree with the theoretical ones, we are going to calculate the theoretical times using the following formula:

$$t2 = \frac{n2^2}{n1^2} \cdot t1$$

1. For n1 = 10000 and n2 = 2*10000

$$t2 = \frac{20000^2}{10000^2} \cdot 491 = 1964$$

2. For n1 = 2*10000 and n2 = 2**2*10000

$$t2 = \frac{40000^2}{20000^2} \cdot 2030 = 8120$$

3. For n1 = 2**2*10000 and n2 = 2**3*10000

$$t2 = \frac{80000^2}{40000^2} \cdot 8794 = 35176$$

After calculating the theoretical values, we can see that they are very similar to the experimental ones. So, the times we have obtained agree with the ones that were expected.

Theoretical values of T reverse:

The complexity of T ordered is n^2. To know if the times we have obtain agree with the theoretical ones, we are going to calculate the theoretical times using the following formula:

$$t2 = \frac{n2^2}{n1^2} \cdot t1$$

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1. For n1 = 10000 and n2 = 2*10000

$$t2 = \frac{20000^2}{10000^2} \cdot 595 = 2380$$

2. For n1 = 2*10000 and n2 = 2**2*10000

$$t2 = \frac{40000^2}{20000^2} \cdot 2341 = 9364$$

3. For n1 = 2**2*10000 and n2 = 2**3*10000

$$t2 = \frac{80000^2}{40000^2} \cdot 8631 = 34524$$

After calculating the theoretical values, we can see that they are very similar to the experimental ones. So, the times we have obtained agree with the ones that were expected

Theoretical values of T random:

The complexity of T ordered is n^2. To know if the times we have obtain agree with the theoretical ones, we are going to calculate the theoretical times using the following formula:

$$t2 = \frac{n2^2}{n1^2} \cdot t1$$

1. For n1 = 10000 and n2 = 2*10000

$$t2 = \frac{20000^2}{10000^2} \cdot 479 = 1916$$

2. For n1 = 2*10000 and n2 = 2**2*10000

$$t2 = \frac{40000^2}{20000^2} \cdot 2021 = 8084$$

3. For n1 = 2**2*10000 and n2 = 2**3*10000

$$t2 = \frac{80000^2}{40000^2} \cdot 8591 = 34364$$

After calculating the theoretical values, we can see that they are very similar to the experimental ones. So, the times we have obtained agree with the ones that were expected

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Activity 3. Insertion algorithm

n	T ordered	T reverse	T random
10000	Lor	739	380
2*10000	Lor	2970	1695
2**2*10000	Lor	11630	6093
2**3*10000	Lor	48975	25773
2**4*10000	Lor	Oot	Oot
2**5*10000	Lor	Oot	Oot
2**6*10000	Lor	Oot	Oot
2**7*10000	Lor	Oot	Oot
2**8*10000	59	Oot	Oot
2**9*10000	231	Oot	Oot
2**10*10000	465	Oot	Oot
2**11*10000	937	Oot	Oot
2**12*10000	1872	Oot	Oot
2**13*10000	3687	Oot	Oot

Theoretical values of T ordered:

The complexity of T ordered is n. To know if the times we have obtain agree with the theoretical ones, we are going to calculate the theoretical times using the following formula:

$$t2 = \frac{n2}{n1} \cdot t1$$

1. For n1 = 2**8*10000 and n2 = 2**9*10000

$$t2 = \frac{5120000}{2560000} \cdot 59 = 118$$

2. For n1 = 2**9*10000 and n2 = 2**10*10000

$$t2 = \frac{10240000}{5120000} \cdot 231 = 462$$

3. For n1 = 2**10*10000 and n2 = 2**11*10000

$$t2 = \frac{20480000}{10240000} \cdot 465 = 930$$

4. For n1 = 2**11*10000 and n2 = 2**12*10000

$$t2 = \frac{40960000}{20480000} \cdot 937 = 1874$$

5. For n1 = 2**12*10000 and n2 = 2**13*10000

$$t2 = \frac{81920000}{40960000} \cdot 1872 = 3744$$

After calculating the theoretical values, we can see that they are very similar to the experimental ones. So, the times we have obtained agree with the ones that were expected.

Theoretical values of T reverse:

The complexity of T ordered is n^2. To know if the times we have obtain agree with the theoretical ones, we are going to calculate the theoretical times using the following formula:

$$t2 = \frac{n2^2}{n1^2} \cdot t1$$

1. For n1 = 10000 and n2 = 2*10000

$$t2 = \frac{20000^2}{10000^2} \cdot 739 = 2956$$

2. For n1 = 2*10000 and n2 = 2**2*10000

$$t2 = \frac{40000^2}{20000^2} \cdot 2970 = 11880$$

3. For n1 = 2**2*10000 and n2 = 2**3*10000

$$t2 = \frac{80000^2}{40000^2} \cdot 11630 = 46520$$

After calculating the theoretical values, we can see that they are very similar to the experimental ones. So, the times we have obtained agree with the ones that were expected

Theoretical values of T random:

The complexity of T ordered is n^2. To know if the times we have obtain agree with the theoretical ones, we are going to calculate the theoretical times using the following formula:

$$t2 = \frac{n2^2}{n1^2} \cdot t1$$

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1. For n1 = 10000 and n2 = 2*10000

$$t2 = \frac{20000^2}{10000^2} \cdot 380 = 1520$$

2. For n1 = 2*10000 and n2 = 2**2*10000

$$t2 = \frac{40000^2}{20000^2} \cdot 1695 = 6780$$

3. For n1 = 2**2*10000 and n2 = 2**3*10000

$$t2 = \frac{80000^2}{40000^2} \cdot 6093 = 24372$$

After calculating the theoretical values, we can see that they are very similar to the experimental ones. So, the times we have obtained agree with the ones that were expected

Activity 4. Quicksort algorithm

n	T ordered	T reverse	T random
250000	96	61	121
2*250000	103	231	254
2**2*250000	211	1041	542
2**3*250000	443	4164	1432
2**4*250000	921	15879	3168
2**5*250000	2089	Oot	6280
2**6*250000	4883	Oot	15973

Theoretical values of T ordered:

The complexity of T ordered is n * log(n). To know if the times we have obtain agree with the theoretical ones, we are going to calculate the theoretical times using the following formula:

$$t2 = \frac{n2 \cdot \log(n2)}{n1 \cdot \log(n1)} \cdot t1$$

1. For n1 = 250000 and n2 = 2*250000

$$t2 = \frac{500000 \cdot \log(500000)}{250000 \cdot \log(250000)} \cdot 96 = 202$$

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2. For n1 = 2*250000 and n2 = 2**2*250000

$$t2 = \frac{1000000 \cdot \log(1000000)}{500000 \cdot \log(500000)} \cdot 103 = 216$$

3. For n1 = 2**2*250000 and n2 = 2**3*250000

$$t2 = \frac{2000000 \cdot \log(2000000)}{1000000 \cdot \log(1000000)} \cdot 211 = 443$$

4. For n1 = 2**3*250000 and n2 = 2**4*250000

$$t2 = \frac{4000000 \cdot \log(4000000)}{2000000 \cdot \log(2000000)} \cdot 443 = 928$$

5. For n1 = 2**4*250000 and n2 = 2**5*250000

$$t2 = \frac{8000000 \cdot \log(8000000)}{4000000 \cdot \log(4000000)} \cdot 921 = 1925$$

6. For n1 = 2**5*250000 and n2 = 2**6*250000

$$t2 = \frac{16000000 \cdot \log(16000000)}{8000000 \cdot \log(8000000)} \cdot 2089 = 4360$$

After calculating the theoretical values, we can see that they are very similar to the experimental ones. So, the times we have obtained agree with the ones that were expected.

Theoretical values of T reverse:

The complexity of T ordered is n^2. To know if the times we have obtain agree with the theoretical ones, we are going to calculate the theoretical times using the following formula:

$$t2 = \frac{n2^2}{n1^2} \cdot t1$$

1. For n1 = 250000 and n2 = 2*250000

$$t2 = \frac{500000^2}{250000^2} \cdot 61 = 244$$

2. For n1 = 2*250000 and n2 = 2**2*250000

$$t2 = \frac{1000000^2}{500000^2} \cdot 231 = 924$$

3. For n1 = 2**2*250000 and n2 = 2**3*250000

$$t2 = \frac{2000000^2}{1000000^2} \cdot 1041 = 4164$$

4. For n1 = 2**3*250000 and n2 = 2**4*250000

$$t2 = \frac{4000000^2}{2000000^2} \cdot 4164 = 16656$$

After calculating the theoretical values, we can see that they are very similar to the experimental ones. So, the times we have obtained agree with the ones that were expected. It is slower that the ordered one because it has higher complexity.

Theoretical values of T random:

The complexity of T ordered is n * log(n). To know if the times we have obtain agree with the theoretical ones, we are going to calculate the theoretical times using the following formula:

$$t2 = \frac{n2 \cdot \log(n2)}{n1 \cdot \log(n1)} \cdot t1$$

1. For n1 = 250000 and n2 = 2*250000

$$t2 = \frac{500000 \cdot \log(500000)}{250000 \cdot \log(250000)} \cdot 121 = 255$$

2. For n1 = 2*250000 and n2 = 2**2*250000

$$t2 = \frac{1000000 \cdot \log(1000000)}{500000 \cdot \log(500000)} \cdot 254 = 534$$

3. For n1 = 2**2*250000 and n2 = 2**3*250000

$$t2 = \frac{2000000 \cdot \log(2000000)}{1000000 \cdot \log(1000000)} \cdot 542 = 1138$$

4. For n1 = 2**3*250000 and n2 = 2**4*250000

$$t2 = \frac{4000000 \cdot \log(4000000)}{2000000 \cdot \log(2000000)} \cdot 1432 = 3000$$

5. For n1 = 2**4*250000 and n2 = 2**5*250000

$$t2 = \frac{8000000 \cdot \log(8000000)}{4000000 \cdot \log(4000000)} \cdot 3168 = 6624$$

6. For n1 = 2**5*250000 and n2 = 2**6*250000

$$t2 = \frac{16000000 \cdot \log(16000000)}{8000000 \cdot \log(8000000)} \cdot 6280 = 13107$$

After calculating the theoretical values, we can see that they are very similar to the experimental ones. So, the times we have obtained agree with the ones that were expected

Activity 5. Quicksort + Insertion algorithm

n	T random
Quicksort	2589
Quicksort + Insertion (k = 5)	2648
Quicksort + Insertion (k = 10)	2552
Quicksort + Insertion (k = 20)	2600
Quicksort + Insertion (k = 30)	2623
Quicksort + Insertion (k = 50)	2634
Quicksort + Insertion (k = 100)	2539
Quicksort + Insertion (k = 200)	2776
Quicksort + Insertion (k = 500)	2617
Quicksort + Insertion (k = 1000)	2537

While the k is small the algorithm is behaving like the quick sort algorithm and when the k is much larger the algorithm is behaving like the insertion algorithm.