


Algorithmics	Student information	Date	Number of session
	UO:293693	22/02	2
	Surname: Castro Álvarez	 Escuela de Ingeniería Informática Universidad de Oviedo	
	Name: Ana		



## Activity 2. Direct exchange or Bubble algorithm

n	t ordered	t reversed	t random
10000	575	1325	1389
2 * 10000	2243	5475	5500
2**2*10000	9985	22391	23686
2**3*10000	38705	OoT	OoT
2**4*10000	OoT	OoT	OoT

Ordered

$$n_1 = 10000 ; n_2 = 20000 ; t_2 = \frac{n_2^2}{n_1^2} \cdot t_1 = \frac{20000^2}{10000^2} \cdot 575 = 2300$$

Measured = 2243

$$n_1 = 20000 ; n_2 = 40000 ; t_2 = \frac{n_2^2}{n_1^2} \cdot t_1 = \frac{40000^2}{20000^2} \cdot 2243 = 8972$$

Measured = 9985

Reversed

$$n_1 = 10000 ; n_2 = 20000 ; t_2 = \frac{n_2^2}{n_1^2} \cdot t_1 = \frac{20000^2}{10000^2} \cdot 1325 = 5300$$

Measured = 5475

$$n_1 = 20000 ; n_2 = 40000 ; t_2 = \frac{n_2^2}{n_1^2} \cdot t_1 = \frac{40000^2}{20000^2} \cdot 5475 = 21900$$

Measured = 22391

Random

$$n_1 = 10000 ; n_2 = 20000 ; t_2 = \frac{n_2^2}{n_1^2} \cdot t_1 = \frac{20000^2}{10000^2} \cdot 1389 = 5556$$

Measured = 5500

$$n_1 = 20000 ; n_2 = 40000 ; t_2 = \frac{n_2^2}{n_1^2} \cdot t_1 = \frac{40000^2}{20000^2} \cdot 5500 = 22000$$

Measured = 23686

## Activity 3. Selection algorithm

n	t ordered	t reversed	t random
10000	490	773	502
2 * 10000	2005	2202	1973
2**2*10000	7995	8815	8274
2**3*10000	33586	35819	30483
2**4*10000	OoT	OoT	Oo

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#### Ordered

$$n_1 = 10000 ; n_2 = 20000 ; t_2 = \frac{n_2^2}{n_1^2} \cdot t_1 = \frac{20000^2}{10000^2} \cdot 490 = 1960$$

Measured = 2005

$$n_1 = 20000 ; n_2 = 40000 ; t_2 = \frac{n_2^2}{n_1^2} \cdot t_1 = \frac{40000^2}{20000^2} \cdot 2005 = 8020$$

Measured = 7995

$$n_1 = 40000 ; n_2 = 80000 ; t_2 = \frac{n_2^2}{n_1^2} \cdot t_1 = \frac{80000^2}{40000^2} \cdot 7995 = 31980$$

Measured = 33586

#### Reversed

$$n_1 = 10000 ; n_2 = 20000 ; t_2 = \frac{n_2^2}{n_1^2} \cdot t_1 = \frac{20000^2}{10000^2} \cdot 773 = 3092$$

Measured = 2202

$$n_1 = 20000 ; n_2 = 40000 ; t_2 = \frac{n_2^2}{n_1^2} \cdot t_1 = \frac{40000^2}{20000^2} \cdot 2202 = 8808$$

Measured = 8815

$$n_1 = 40000 ; n_2 = 80000 ; t_2 = \frac{n_2^2}{n_1^2} \cdot t_1 = \frac{80000^2}{40000^2} \cdot 8815 = 35260$$

Measured = 35819

#### Random

$$n_1 = 10000 ; n_2 = 20000 ; t_2 = \frac{n_2^2}{n_1^2} \cdot t_1 = \frac{20000^2}{10000^2} \cdot 502 = 2008$$

Measured = 1973

$$n_1 = 20000 ; n_2 = 40000 ; t_2 = \frac{n_2^2}{n_1^2} \cdot t_1 = \frac{40000^2}{20000^2} \cdot 1973 = 7892$$

Measured = 8274

$$n_1 = 40000 ; n_2 = 80000 ; t_2 = \frac{n_2^2}{n_1^2} \cdot t_1 = \frac{80000^2}{40000^2} \cdot 8274 = 33096$$

Measured = 30483

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## Activity 4. Insertion algorithm

n	t ordered	t reversed	t random
10000	LoR	736	367
2 * 10000	LoR	2902	1459
2**2*10000	LoR	11597	5853
2**3*10000	LoR	49273	23718
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	60	OoT	OoT
2**9*10000	117	OoT	OoT
2**10*10000	238	OoT	OoT
2**11*10000	470	OoT	OoT
2**12*10000	938	OoT	OoT
2**13*10000	1898	OoT	OoT

Ordered

$$n_1 = 2560000; n_2 = 5120000; t_2 = \frac{n_2}{n_1} \cdot t_1 = \frac{5120000}{2560000} \cdot 60 = 120$$

Measured = 117

$$n_1 = 5120000; n_2 = 10240000; t_2 = \frac{n_2}{n_1} \cdot t_1 = \frac{10240000}{5120000} \cdot 117 = 234$$

Measured = 238

$$n_1 = 10240000; n_2 = 20480000; t_2 = \frac{n_2}{n_1} \cdot t_1 = \frac{20480000}{10240000} \cdot 238 = 476$$

Measured = 470

Reversed

$$n_1 = 10000; n_2 = 20000; t_2 = \frac{n_2^2}{n_1^2} \cdot t_1 = \frac{20000^2}{10000^2} \cdot 736 = 2944$$

Measured = 2902

$$n_1 = 20000; n_2 = 40000; t_2 = \frac{n_2^2}{n_1^2} \cdot t_1 = \frac{40000^2}{20000^2} \cdot 2902 = 11608$$

Measured = 11597

$$n_1 = 40000; n_2 = 80000; t_2 = \frac{n_2^2}{n_1^2} \cdot t_1 = \frac{80000^2}{40000^2} \cdot 11597 = 46388$$

Measured = 49273

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Random

$$n_1 = 10000 ; n_2 = 20000 ; t_2 = \frac{n_2^2}{n_1^2} \cdot t_1 = \frac{20000^2}{10000^2} \cdot 367 = 1468$$

Measured = 1459

$$n_1 = 20000 ; n_2 = 40000 ; t_2 = \frac{n_2^2}{n_1^2} \cdot t_1 = \frac{40000^2}{20000^2} \cdot 1459 = 5836$$

Measured = 5853

$$n_1 = 40000 ; n_2 = 80000 ; t_2 = \frac{n_2^2}{n_1^2} \cdot t_1 = \frac{80000^2}{40000^2} \cdot 5853 = 23412$$

Measured = 23718

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## Activity 5. Quicksort algorithm

n	t ordered	t reversed	t random
250000	LoR	59	124
2*250000	102	112	251
2**2*250000	213	232	545
2**3*250000	433	477	1158
2**4*250000	907	1096	2596
2**5*250000	2481	2035	6178
2**6*250000	5067	4184	18199

Ordered

$$\begin{aligned}
 n_1 = 500000 ; n_2 = 1000000 ; t_2 &= \frac{n_2 \cdot \log_2 n_2}{n_1 \cdot \log_2 n_1} \cdot t_1 \\
 &= \frac{1000000 \cdot \log_2 1000000}{500000 \cdot \log_2 500000} \cdot 102 = 214
 \end{aligned}$$

Measured = 213

$$\begin{aligned}
 n_1 = 1000000 ; n_2 = 2000000 ; t_2 &= \frac{n_2 \cdot \log_2 n_2}{n_1 \cdot \log_2 n_1} \cdot t_1 \\
 &= \frac{2000000 \cdot \log_2 2000000}{1000000 \cdot \log_2 1000000} \cdot 213 = 447
 \end{aligned}$$

Measured = 433

$$\begin{aligned}
 n_1 = 2000000 ; n_2 = 4000000 ; t_2 &= \frac{n_2 \cdot \log_2 n_2}{n_1 \cdot \log_2 n_1} \cdot t_1 \\
 &= \frac{4000000 \cdot \log_2 4000000}{2000000 \cdot \log_2 2000000} \cdot 433 = 907
 \end{aligned}$$

Measured = 907

Reversed

$$\begin{aligned}
 n_1 = 500000 ; n_2 = 1000000 ; t_2 &= \frac{n_2 \cdot \log_2 n_2}{n_1 \cdot \log_2 n_1} \cdot t_1 \\
 &= \frac{1000000 \cdot \log_2 1000000}{500000 \cdot \log_2 500000} \cdot 59 = 124
 \end{aligned}$$

Measured = 232

$$\begin{aligned}
 n_1 = 1000000 ; n_2 = 2000000 ; t_2 &= \frac{n_2 \cdot \log_2 n_2}{n_1 \cdot \log_2 n_1} \cdot t_1 \\
 &= \frac{2000000 \cdot \log_2 2000000}{1000000 \cdot \log_2 1000000} \cdot 232 = 487
 \end{aligned}$$

Measured = 477

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$$n_1 = 2000000 ; n_2 = 4000000 ; t_2 = \frac{n_2 \cdot \log_2 n_2}{n_1 \cdot \log_2 n_1} \cdot t_1$$

$$= \frac{4000000 \cdot \log_2 4000000}{2000000 \cdot \log_2 2000000} \cdot 477 = 999$$

Measured = 1096

Random

$$n_1 = 500000 ; n_2 = 1000000 ; t_2 = \frac{n_2 \cdot \log_2 n_2}{n_1 \cdot \log_2 n_1} \cdot t_1$$

$$= \frac{1000000 \cdot \log_2 1000000}{500000 \cdot \log_2 500000} \cdot 124 = 261$$

Measured = 545

$$n_1 = 1000000 ; n_2 = 2000000 ; t_2 = \frac{n_2 \cdot \log_2 n_2}{n_1 \cdot \log_2 n_1} \cdot t_1$$

$$= \frac{2000000 \cdot \log_2 2000000}{1000000 \cdot \log_2 1000000} \cdot 545 = 1144$$

Measured = 1158

$$n_1 = 2000000 ; n_2 = 4000000 ; t_2 = \frac{n_2 \cdot \log_2 n_2}{n_1 \cdot \log_2 n_1} \cdot t_1$$

$$= \frac{4000000 \cdot \log_2 4000000}{2000000 \cdot \log_2 2000000} \cdot 1158 = 2426$$

Measured = 2596

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## Activity 6. Quicksort + Insertion algorithm

n	t random
Quicksort	38960
Quicksort+Insertion (k=5)	36405
Quicksort+Insertion (k=10)	35827
Quicksort+Insertion (k=20)	35378
Quicksort+Insertion (k=30)	35347
Quicksort+Insertion (k=50)	33564
Quicksort+Insertion (k=100)	30738
Quicksort+Insertion (k=200)	26696
Quicksort+Insertion (k=500)	36495
Quicksort+Insertion (k=1000)	62174

When k is very small it is only executing Quicksort and when k is very big it is only executing Insertion, that's why the time starts high then starts to decrease and it finally increases again. Because both algorithms start to be equilibrated until they both find the "perfect" point and after they pass that point, they again start to disequilibrate