Link do Github: github.com/tmendes/PAD/

Desenvolvimento:

Programa criado: mMatSerial - programa escrito de forma serial que realiza as operações entre as matrizes

Programa criado: mMatOpen - programa escrito de forma paralela que realiza as operações entre as matrizes
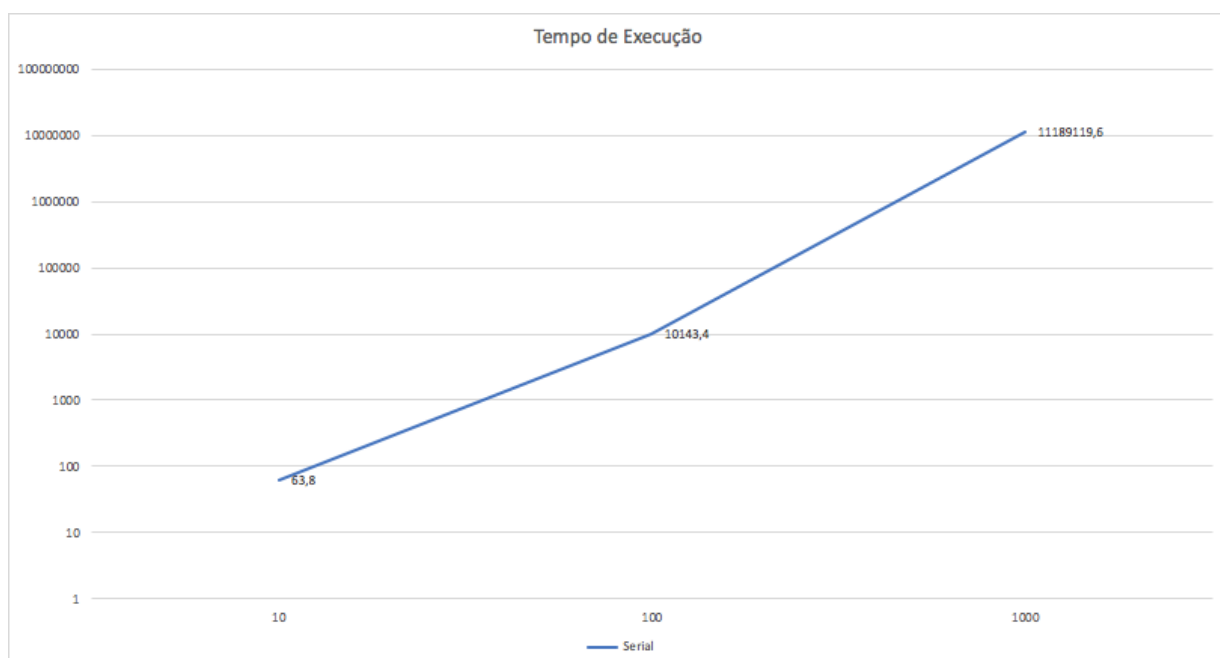
instruções para execução

```
./mMatSerial      lin_mat1 col_mat1 fil_mat1 lin_mat2 col_mat2 fil_mat2 lin_mat3 col_mat3 fil_mat3
./mMatOpen  n_thr  lin_mat1 col_mat1 fil_mat1 lin_mat2 col_mat2 fil_mat2 lin_mat3 col_mat3 fil_mat3
```

Os tempos calculados para os exercícios propostos foram calculados através de médias devido a possíveis variações encontradas no ambiente usado para execução dos mesmos, os passos para cálculo das mesmas estão descritos no Apêndice I no final deste relatório.

Exercício – Crie um programa serial e um programa paralelo com OpenMP que calcule a operação matricial D = A * B + C, onde todas as matrizes são n x n. Prepare-se para gerar gráficos para cada um dos itens a seguir.

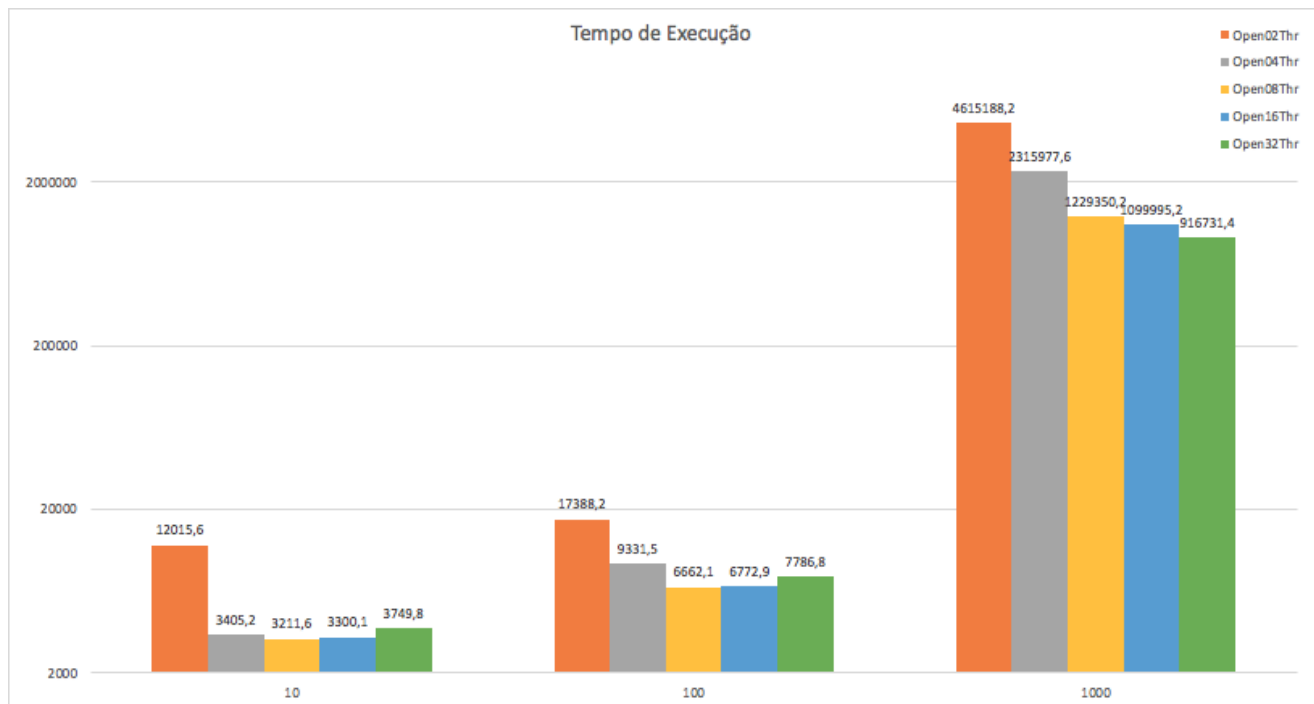a. Calcule o tempo de execução do programa serial para matrizes de tamanho 10X10; $10^2 X 10^2$; $10^3 X 10^3$.

Tipo	10	100	1000
Serial	63,8	10143,4	11189119,6

b. Calcule o tempo de execução do programa paralelo para matrizes de tamanho 10X10; 10^2X10^2; 10^3X10^3 com 2, 4, 8, 16 e 32 threads.

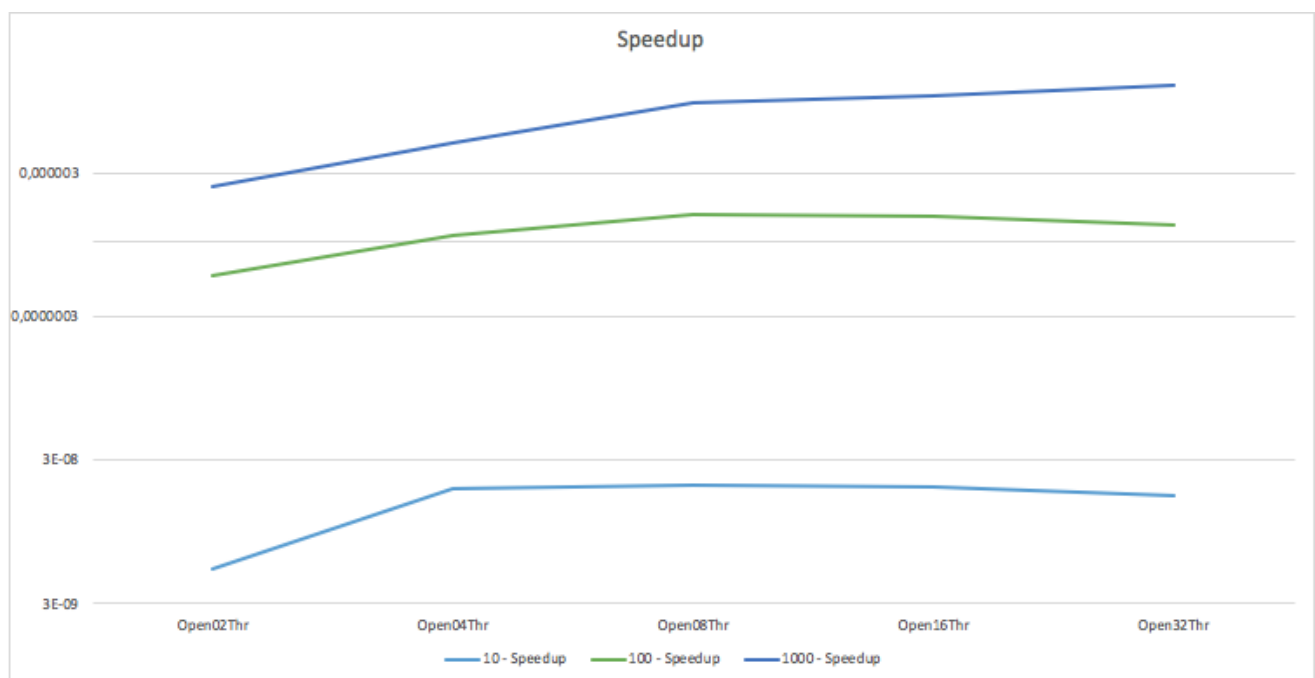| Tipo	10	100	1000
Open02Thr	12015,6	17388,2	4615188,2
Open04Thr	3405,2	9331,5	2315977,6
Open08Thr	3211,6	6662,1	1229350,2
Open16Thr	3300,1	6772,9	1099995,2
Open32Thr	3749,8	7786,8	916731,4

c. Responda as perguntas a seguir no relatório:

• Há necessidade de sincronização entre os threads para resolver a multiplicação?
Não há necessidade, pois os dados não dependem de informações entre os laçoes, entretanto é preciso sincronizar para garantir que a Thread principal não termine antes da execução da demais.

• Qual foi o speedup em relação ao programa serial em cada uma das execuções?

Tipo	10 - Speedup	100 - Speedup	1000 - Speedup
Open02Thr	0,00530976	0,583349628	2,424412422
Open04Thr	0,01873605	1,087006376	4,831272807
Open08Thr	0,01986549	1,522552949	9,10165354
Open16Thr	0,01933275	1,497645027	10,1719713
Open32Thr	0,01701424	1,302640366	12,20545036

• Houve algum caso em que não houve speedup em relação ao programa serial? Se houve, qual a razão para isso?

Sim, na tabela anterior os casos que não estão com a cor verde de fundo (valores menores que 1), não apresentaram speedup, nesses casos o custo para se criar as Threads supera o tempo da execução do programa Serial.

APÊNDICE I - CÁLCULO MÉDIO DAS EXECUÇÕES

Tipo	Dimensão	ini_mult_mat	fim_mult_mat	tmp_mult
Serial	1000	08-05-2018 11:55:27.702770	08-05-2018 11:55:39.78127	11375357
Serial	1000	08-05-2018 11:55:39.325865	08-05-2018 11:55:50.590438	11264573
Serial	1000	08-05-2018 11:55:50.838460	08-05-2018 11:56:01.997882	11159422
Serial	1000	08-05-2018 11:56:02.247245	08-05-2018 11:56:13.402197	11154952
Serial	1000	08-05-2018 11:56:13.649905	08-05-2018 11:56:24.801818	11151913
Serial	1000	08-05-2018 11:56:25.51045	08-05-2018 11:56:36.199232	11148187
Serial	1000	08-05-2018 11:56:36.447654	08-05-2018 11:56:47.648970	11201316
Serial	1000	08-05-2018 11:56:47.896849	08-05-2018 11:56:59.54587	11157738
Serial	1000	08-05-2018 11:56:59.304534	08-05-2018 11:57:10.444096	11139562
Serial	1000	08-05-2018 11:57:10.692960	08-05-2018 11:57:21.831136	11138176
Serial 1000 Média				11189119,6
Serial	100	08-05-2018 11:57:21.886344	08-05-2018 11:57:21.896473	10129
Serial	100	08-05-2018 11:57:21.946037	08-05-2018 11:57:21.956181	10144
Serial	100	08-05-2018 11:57:22.5385	08-05-2018 11:57:22.15555	10170
Serial	100	08-05-2018 11:57:22.64564	08-05-2018 11:57:22.74732	10168
Serial	100	08-05-2018 11:57:22.124149	08-05-2018 11:57:22.134306	10157
Serial	100	08-05-2018 11:57:22.183337	08-05-2018 11:57:22.193489	10152
Serial	100	08-05-2018 11:57:22.242745	08-05-2018 11:57:22.252876	10131
Serial	100	08-05-2018 11:57:22.302268	08-05-2018 11:57:22.312415	10147
Serial	100	08-05-2018 11:57:22.361808	08-05-2018 11:57:22.371950	10142
Serial	100	08-05-2018 11:57:22.421449	08-05-2018 11:57:22.431543	10094
Serial 100 Média				10143,4
Serial	10	08-05-2018 11:57:22.477077	08-05-2018 11:57:22.477141	64
Serial	10	08-05-2018 11:57:22.522718	08-05-2018 11:57:22.522782	64

Serial	10	08-05-2018 11:57:22.569444	08-05-2018 11:57:22.569507	63
Serial	10	08-05-2018 11:57:22.614507	08-05-2018 11:57:22.614570	63
Serial	10	08-05-2018 11:57:22.659545	08-05-2018 11:57:22.659609	64
Serial	10	08-05-2018 11:57:22.705891	08-05-2018 11:57:22.705955	64
Serial	10	08-05-2018 11:57:22.753438	08-05-2018 11:57:22.753502	64
Serial	10	08-05-2018 11:57:22.797966	08-05-2018 11:57:22.798030	64
Serial	10	08-05-2018 11:57:22.842871	08-05-2018 11:57:22.842935	64
Serial	10	08-05-2018 11:57:22.888262	08-05-2018 11:57:22.888326	64
Serial 10 Média				63,8
Open2	10	08-05-2018 12:07:37.548322	08-05-2018 12:07:37.552707	4385
Open2	10	08-05-2018 12:07:37.659074	08-05-2018 12:07:37.666837	7763
Open2	10	08-05-2018 12:07:37.727051	08-05-2018 12:07:37.731480	4429
Open2	10	08-05-2018 12:07:37.782885	08-05-2018 12:07:37.787525	4640
Open2	10	08-05-2018 12:07:37.841603	08-05-2018 12:07:37.845988	4385
Open2	10	08-05-2018 12:07:37.908442	08-05-2018 12:07:37.956733	48291
Open2	10	08-05-2018 12:07:38.27778	08-05-2018 12:07:38.32719	4941
Open2	10	08-05-2018 12:07:38.131332	08-05-2018 12:07:38.136734	5402
Open2	10	08-05-2018 12:07:38.210478	08-05-2018 12:07:38.214922	4444
Open2	10	08-05-2018 12:07:38.285274	08-05-2018 12:07:38.316750	31476
Open2 10 Média				12015,6
Open4	10	08-05-2018 12:07:38.395043	08-05-2018 12:07:38.400721	5678
Open4	10	08-05-2018 12:07:38.470193	08-05-2018 12:07:38.473273	3080
Open4	10	08-05-2018 12:07:38.524413	08-05-2018 12:07:38.527718	3305
Open4	10	08-05-2018 12:07:38.578966	08-05-2018 12:07:38.582099	3133
Open4	10	08-05-2018 12:07:38.633264	08-05-2018 12:07:38.636359	3095
Open4	10	08-05-2018 12:07:38.687421	08-05-2018 12:07:38.690555	3134
Open4	10	08-05-2018 12:07:38.742127	08-05-2018 12:07:38.745385	3258
Open4	10	08-05-2018 12:07:38.796727	08-05-2018 12:07:38.799802	3075

Relatório - Laboratório de Programação OpenMP
Prof. André Leon S. Gradvohl, Dr.
Aluno: Thiago Gonçalves Mendes RA 210905

UNICAMP

Open4	10	08-05-2018 12:07:38.850958	08-05-2018 12:07:38.854037	3079
Open4	10	08-05-2018 12:07:38.905663	08-05-2018 12:07:38.908878	3215
Open4 10 Média				3405,2
Open8	10	08-05-2018 12:07:38.960459	08-05-2018 12:07:38.963595	3136
Open8	10	08-05-2018 12:07:39.14841	08-05-2018 12:07:39.18075	3234
Open8	10	08-05-2018 12:07:39.69348	08-05-2018 12:07:39.72520	3172
Open8	10	08-05-2018 12:07:39.127078	08-05-2018 12:07:39.130276	3198
Open8	10	08-05-2018 12:07:39.181588	08-05-2018 12:07:39.184656	3068
Open8	10	08-05-2018 12:07:39.237107	08-05-2018 12:07:39.240453	3346
Open8	10	08-05-2018 12:07:39.294196	08-05-2018 12:07:39.297380	3184
Open8	10	08-05-2018 12:07:39.351047	08-05-2018 12:07:39.354439	3392
Open8	10	08-05-2018 12:07:39.406320	08-05-2018 12:07:39.409511	3191
Open8	10	08-05-2018 12:07:39.460842	08-05-2018 12:07:39.464037	3195
Open8 10 Média				3211,6
Open16	10	08-05-2018 12:07:39.516341	08-05-2018 12:07:39.519505	3164
Open16	10	08-05-2018 12:07:39.572464	08-05-2018 12:07:39.575811	3347
Open16	10	08-05-2018 12:07:39.628302	08-05-2018 12:07:39.631509	3207
Open16	10	08-05-2018 12:07:39.682642	08-05-2018 12:07:39.685915	3273
Open16	10	08-05-2018 12:07:39.739669	08-05-2018 12:07:39.742950	3281
Open16	10	08-05-2018 12:07:39.794517	08-05-2018 12:07:39.797762	3245
Open16	10	08-05-2018 12:07:39.850168	08-05-2018 12:07:39.853533	3365
Open16	10	08-05-2018 12:07:39.904824	08-05-2018 12:07:39.908019	3195
Open16	10	08-05-2018 12:07:39.959216	08-05-2018 12:07:39.962815	3599
Open16	10	08-05-2018 12:07:40.17141	08-05-2018 12:07:40.20466	3325
Open16 10 Média				3300,1
Open32	10	08-05-2018 12:07:40.73299	08-05-2018 12:07:40.76616	3317
Open32	10	08-05-2018 12:07:40.127698	08-05-2018 12:07:40.130950	3252
Open32	10	08-05-2018 12:07:40.181308	08-05-2018 12:07:40.184555	3247

Open32	10	08-05-2018 12:07:40.235312	08-05-2018 12:07:40.239523	4211
Open32	10	08-05-2018 12:07:40.290253	08-05-2018 12:07:40.293717	3464
Open32	10	08-05-2018 12:07:40.345952	08-05-2018 12:07:40.349266	3314
Open32	10	08-05-2018 12:07:40.399923	08-05-2018 12:07:40.403304	3381
Open32	10	08-05-2018 12:07:40.455111	08-05-2018 12:07:40.458476	3365
Open32	10	08-05-2018 12:07:40.509282	08-05-2018 12:07:40.515840	6558
Open32	10	08-05-2018 12:07:40.570205	08-05-2018 12:07:40.573594	3389
Open32 10 Média				3749,8
Open2	100	08-05-2018 12:08:40.437127	08-05-2018 12:08:40.455235	18108
Open2	100	08-05-2018 12:08:40.541997	08-05-2018 12:08:40.566744	24747
Open2	100	08-05-2018 12:08:40.631280	08-05-2018 12:08:40.643955	12675
Open2	100	08-05-2018 12:08:40.700201	08-05-2018 12:08:40.712879	12678
Open2	100	08-05-2018 12:08:40.768669	08-05-2018 12:08:40.781369	12700
Open2	100	08-05-2018 12:08:40.838766	08-05-2018 12:08:40.852811	14045
Open2	100	08-05-2018 12:08:40.945617	08-05-2018 12:08:40.978393	32776
Open2	100	08-05-2018 12:08:41.50264	08-05-2018 12:08:41.65106	14842
Open2	100	08-05-2018 12:08:41.155451	08-05-2018 12:08:41.178264	22813
Open2	100	08-05-2018 12:08:41.250404	08-05-2018 12:08:41.258902	8498
Open2 100 Média				17388,2
Open4	100	08-05-2018 12:08:41.315482	08-05-2018 12:08:41.328236	12754
Open4	100	08-05-2018 12:08:41.383538	08-05-2018 12:08:41.396440	12902
Open4	100	08-05-2018 12:08:41.452984	08-05-2018 12:08:41.465838	12854
Open4	100	08-05-2018 12:08:41.521490	08-05-2018 12:08:41.532655	11165
Open4	100	08-05-2018 12:08:41.588375	08-05-2018 12:08:41.595669	7294
Open4	100	08-05-2018 12:08:41.651015	08-05-2018 12:08:41.658279	7264
Open4	100	08-05-2018 12:08:41.713466	08-05-2018 12:08:41.720751	7285
Open4	100	08-05-2018 12:08:41.780557	08-05-2018 12:08:41.787796	7239
Open4	100	08-05-2018 12:08:41.844384	08-05-2018 12:08:41.851730	7346

Open4	100	08-05-2018 12:08:41.906590	08-05-2018 12:08:41.913802	7212
Open4 100 Média				9331,5
Open8	100	08-05-2018 12:08:41.968985	08-05-2018 12:08:41.975054	6069
Open8	100	08-05-2018 12:08:42.29498	08-05-2018 12:08:42.35580	6082
Open8	100	08-05-2018 12:08:42.90048	08-05-2018 12:08:42.96062	6014
Open8	100	08-05-2018 12:08:42.151181	08-05-2018 12:08:42.157247	6066
Open8	100	08-05-2018 12:08:42.212633	08-05-2018 12:08:42.219077	6444
Open8	100	08-05-2018 12:08:42.274625	08-05-2018 12:08:42.282038	7413
Open8	100	08-05-2018 12:08:42.337094	08-05-2018 12:08:42.344663	7569
Open8	100	08-05-2018 12:08:42.400258	08-05-2018 12:08:42.407707	7449
Open8	100	08-05-2018 12:08:42.462906	08-05-2018 12:08:42.469018	6112
Open8	100	08-05-2018 12:08:42.524494	08-05-2018 12:08:42.531897	7403
Open8 100 Média				6662,1
Open16	100	08-05-2018 12:08:42.587374	08-05-2018 12:08:42.593427	6053
Open16	100	08-05-2018 12:08:42.648834	08-05-2018 12:08:42.654827	5993
Open16	100	08-05-2018 12:08:42.711281	08-05-2018 12:08:42.719492	8211
Open16	100	08-05-2018 12:08:42.775227	08-05-2018 12:08:42.783437	8210
Open16	100	08-05-2018 12:08:42.839896	08-05-2018 12:08:42.847425	7529
Open16	100	08-05-2018 12:08:42.905911	08-05-2018 12:08:42.912095	6184
Open16	100	08-05-2018 12:08:42.967260	08-05-2018 12:08:42.973341	6081
Open16	100	08-05-2018 12:08:43.28601	08-05-2018 12:08:43.34650	6049
Open16	100	08-05-2018 12:08:43.89737	08-05-2018 12:08:43.95822	6085
Open16	100	08-05-2018 12:08:43.151093	08-05-2018 12:08:43.158427	7334
Open16 100 Média				6772,9
Open32	100	08-05-2018 12:08:43.214614	08-05-2018 12:08:43.220590	5976
Open32	100	08-05-2018 12:08:43.275834	08-05-2018 12:08:43.281995	6161
Open32	100	08-05-2018 12:08:43.336665	08-05-2018 12:08:43.342722	6057
Open32	100	08-05-2018 12:08:43.397731	08-05-2018 12:08:43.403822	6091

Open32	100	08-05-2018 12:08:43.458825	08-05-2018 12:08:43.466535	7710
Open32	100	08-05-2018 12:08:43.521824	08-05-2018 12:08:43.529981	8157
Open32	100	08-05-2018 12:08:43.584958	08-05-2018 12:08:43.592524	7566
Open32	100	08-05-2018 12:08:43.647930	08-05-2018 12:08:43.662682	14752
Open32	100	08-05-2018 12:08:43.721641	08-05-2018 12:08:43.729350	7709
Open32	100	08-05-2018 12:08:43.786076	08-05-2018 12:08:43.793765	7689
Open32 100 Média				7786,8
Open2	1000	08-05-2018 12:11:04.800616	08-05-2018 12:11:09.416488	4615872
Open2	1000	08-05-2018 12:11:09.710411	08-05-2018 12:11:14.324827	4614416
Open2	1000	08-05-2018 12:11:14.619660	08-05-2018 12:11:19.234749	4615089
Open2	1000	08-05-2018 12:11:19.528762	08-05-2018 12:11:24.147414	4618652
Open2	1000	08-05-2018 12:11:24.441359	08-05-2018 12:11:29.57359	4616000
Open2	1000	08-05-2018 12:11:29.350598	08-05-2018 12:11:33.964612	4614014
Open2	1000	08-05-2018 12:11:34.261209	08-05-2018 12:11:38.878405	4617196
Open2	1000	08-05-2018 12:11:39.172848	08-05-2018 12:11:43.784733	4611885
Open2	1000	08-05-2018 12:11:44.80277	08-05-2018 12:11:48.694246	4613969
Open2	1000	08-05-2018 12:11:48.988395	08-05-2018 12:11:53.603184	4614789
Open2 1000 Média				4615188,2
Open4	1000	08-05-2018 12:11:53.897001	08-05-2018 12:11:56.213857	2316856
Open4	1000	08-05-2018 12:11:56.507258	08-05-2018 12:11:58.815908	2308650
Open4	1000	08-05-2018 12:11:59.108663	08-05-2018 12:12:01.424681	2316018
Open4	1000	08-05-2018 12:12:01.717356	08-05-2018 12:12:04.46050	2328694
Open4	1000	08-05-2018 12:12:04.339062	08-05-2018 12:12:06.666950	2327888
Open4	1000	08-05-2018 12:12:06.961531	08-05-2018 12:12:09.272664	2311133
Open4	1000	08-05-2018 12:12:09.566923	08-05-2018 12:12:11.883904	2316981
Open4	1000	08-05-2018 12:12:12.178516	08-05-2018 12:12:14.487985	2309469
Open4	1000	08-05-2018 12:12:14.781158	08-05-2018 12:12:17.96175	2315017
Open4	1000	08-05-2018 12:12:17.388862	08-05-2018 12:12:19.697932	2309070

Open4 1000 Média				2315977,6
Open8	1000	08-05-2018 12:12:19.992123	08-05-2018 12:12:21.306438	1314315
Open8	1000	08-05-2018 12:12:21.599357	08-05-2018 12:12:22.903029	1303672
Open8	1000	08-05-2018 12:12:23.196461	08-05-2018 12:12:24.429044	1232583
Open8	1000	08-05-2018 12:12:24.722017	08-05-2018 12:12:25.911347	1189330
Open8	1000	08-05-2018 12:12:26.206263	08-05-2018 12:12:27.433156	1226893
Open8	1000	08-05-2018 12:12:27.725249	08-05-2018 12:12:28.945705	1220456
Open8	1000	08-05-2018 12:12:29.238245	08-05-2018 12:12:30.426359	1188114
Open8	1000	08-05-2018 12:12:30.721630	08-05-2018 12:12:31.933915	1212285
Open8	1000	08-05-2018 12:12:32.230023	08-05-2018 12:12:33.461259	1231236
Open8	1000	08-05-2018 12:12:33.755903	08-05-2018 12:12:34.930521	1174618
Open8 1000 Média				1229350,2
Open16	1000	08-05-2018 12:12:35.224632	08-05-2018 12:12:36.439556	1214924
Open16	1000	08-05-2018 12:12:36.737676	08-05-2018 12:12:38.334198	1596522
Open16	1000	08-05-2018 12:12:38.628272	08-05-2018 12:12:39.843123	1214851
Open16	1000	08-05-2018 12:12:40.138890	08-05-2018 12:12:40.952193	813303
Open16	1000	08-05-2018 12:12:41.246690	08-05-2018 12:12:42.212054	965364
Open16	1000	08-05-2018 12:12:42.507064	08-05-2018 12:12:43.468240	961176
Open16	1000	08-05-2018 12:12:43.760704	08-05-2018 12:12:44.576619	815915
Open16	1000	08-05-2018 12:12:44.871668	08-05-2018 12:12:46.22413	1150745
Open16	1000	08-05-2018 12:12:46.315256	08-05-2018 12:12:47.467308	1152052
Open16	1000	08-05-2018 12:12:47.764398	08-05-2018 12:12:48.879498	1115100
Open16 1000 Média				1099995,2
Open32	1000	08-05-2018 12:12:49.173615	08-05-2018 12:12:50.81590	907975
Open32	1000	08-05-2018 12:12:50.375842	08-05-2018 12:12:51.281252	905410
Open32	1000	08-05-2018 12:12:51.581776	08-05-2018 12:12:52.469941	888165
Open32	1000	08-05-2018 12:12:52.766300	08-05-2018 12:12:53.657679	891379
Open32	1000	08-05-2018 12:12:53.951076	08-05-2018 12:12:54.859144	908068

Open32	1000	08-05-2018 12:12:55.156290	08-05-2018 12:12:56.68032	911742
Open32	1000	08-05-2018 12:12:56.366847	08-05-2018 12:12:57.344054	977207
Open32	1000	08-05-2018 12:12:57.640225	08-05-2018 12:12:58.639581	999356
Open32	1000	08-05-2018 12:12:58.940853	08-05-2018 12:12:59.831024	890171
Open32	1000	08-05-2018 12:13:00.130627	08-05-2018 12:13:01.18468	887841
Open32 1000 Média				916731,4