Name: Monica Karam

N = 73

Lab Assignment 2: Threads

## • Code Organization:

#### • int rowMultiply():

For each row in MAT1 creates a thread that calculates the first row elements in MAT3.

#### • void\* row calculate(void\* tid):

Function used by thread to calculate the elem. of MAT3[tid]

#### • int elementMult():

For each element in MAT3 creates a thread

#### • void\* element calculate(void\* tid):

Calculates the value of MAT3[ROW][COL]

#### • char\* copyString(char\* d, char\* append)

Set the file names from input

#### • int ReadFile(char\* f1, int first);

Opens file

## • int scanFirst(FILE\* fp);

Save first matrix from file to MAT1

#### • int scanSecond(FILE\* fp);

Save second matrix from file to MAT2

#### • int print(char\* name)

Print the output to its corresponding file

#### • int check()

Check for the correctness of dimensions for Matrix multiplication

### • Main Function:

#### • int rowMultiply():

for each row creates a thread , if it returns a value to indicate the failure of creating it , an error message in printed with the error indicated by this code. Otherwise, it waits for all threads to terminate and then returns.

- void\* row calculate(void\* tid):
  - tid  $\rightarrow$  indicates the row to be calculated.
- int elementMult():

For each combination of  $(row,col) \rightarrow creates$  a thread to calculate the matrix element mat[row][col].

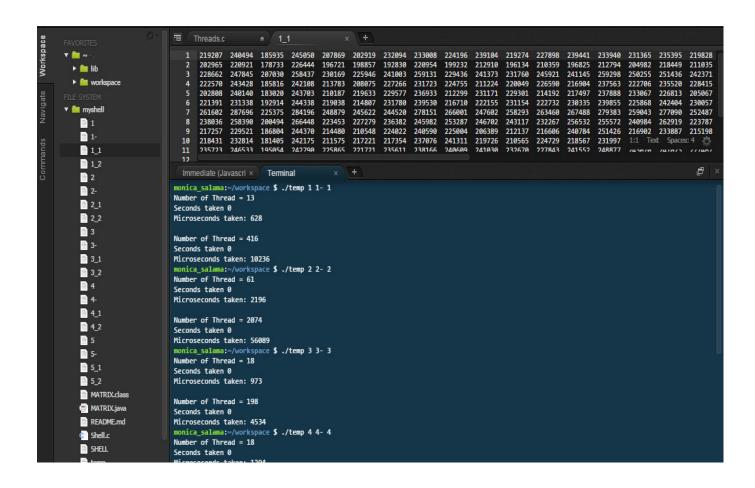
- void\* element calculate(void\* tid):
   casts tid → to its corresponding struct element.
   Calculates the value of MAT3[ROW][COL].
- How to compile and run code:
- make
- ./matMultp FirstMatrixFile SecondMatrixFile OutputFile

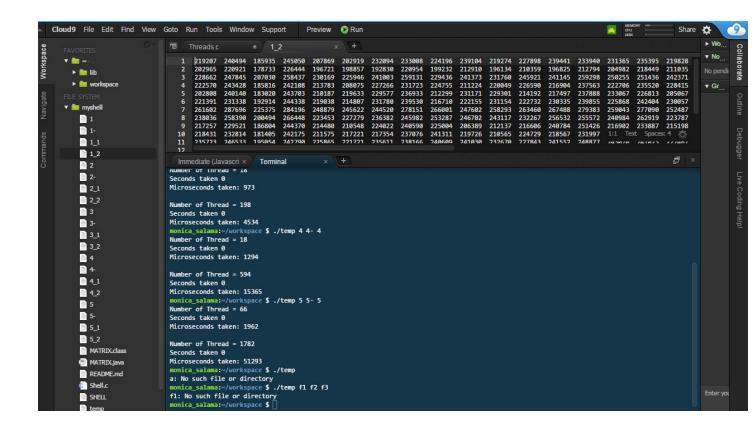
# • **Comparaison**:

	(Row ,Element)	(Row ,Element)	(Row ,Element)	(Row ,Element)	(Row ,Element)
(row1 , col1) , (row2,col2)	(13,90),(90,32)	(61,79),(79,34)	(18,25),(25,11)	(18,41),(41,33)	(66,21),(21,27)
Time (s)	(0) , (0)	(0) , (0)	(0) , (0)	(0) , (0)	(0) , (0)
Time(micros)	(628),(10236)	(2196),(56089)	(973),(4534)	(1294) , (15365)	(1962),(51293)
	(1.5) (1.15)	(2.1) (2.2-1)	() ()	(+ -) ()	(22) (1222)
Number Of Threads	(13), (416)	(61),(2074)	(18) , (198)	(18) , (594)	(66),(1782)
	l	l		l	1

	Method 1 : Row	Method 2 : Element
<u>Speed</u>	faster	slower
Number of Threads	less	more

## Sample Runs:







1	Threa	ds.c				2				×	X.	3				Х	2-				- 5	< \	+	-	- 1/1					M.F		1/11		
1	row	<b>-79</b>	col=	34																														
5					45	75	100	41	54	68	18	45	17	91	35	8	54	22	9	18	39	59	60	25	70	29	10	77	76	49	23	32	67	72
3		39	8	32	27	8		71		62		7	45	95		72	86		37			61		80	9	38	72	81	95	93	75	6	45	94
4	78	70	22	81	13	2	41	4	71	24	16	62	76	7	42	89	84	47	70	13	64	1	44	32	63	8	45	3	32	63	15	31	15	91
5	76	66	30	26	89	4	42	70	83	49	35	76	52	17	48	87	59	3	57	9	59	88	4	70	98	60	54	4	23	91	83	16	37	69
6	60	54	39	13	33	37	26	68	56	42	18	50	74	78	97	14	25	75	53	10	22	43	65	95	48	93	56	26	55	50	82	17	39	83
7	31	13	5	1	78	88	76	6	51		100	83				44	12				46	48		1	42	48	77	23	94	39	100	45	53	22
8	96	94	42	60	51	7	14	19	96	90	74	48	52		54	8	94	26	70	56	55	88	88	69	35	73	65	77	35	43	25	81	40	56
9	94	12	84	78	37	27	97	15	13	39	91	49			32		64	73	87	11		64	80	38	8	66	84	78	59	81	32	15	87	72
10	25	66	26	87	27	94	57	79	78	65	99	100		9	13		48	42	92	79	92	40	3	26	34	73	67	77	64	99	13	93	95	56
11	55	40	22	15	79	60	61	24	9		37		52	4			53	4	64		76			76	24	32	20	97	94	42	73	75	10	90
12		35	74	47	83	22	43	52	69	89	98	29	31		51	83	70	31	38	17	7	96	100		25	71	96	76	81	20	52	84	12	44
13 14	42 38	3 64	5 47	25 7	77 27	18 56	71 28	59 77	5 14	76 76	78 38	55 43	26 100	22	86		50	43 66	10	49 53	85 98	66 83	53	46 7	7 93	9 31	19	99 72	45 27	16	83 59	59 19	52 79	61
15		17	25	21	92	52	82	68	95	59	88	32					94	35	99		17			100		81	12	95	88	39	100		18	20
16		76	27	98	31	68	45	2	55	18	8	13	38				71		61	4	19	31	1	35	90	93	22	8	57	94	52	26	8	67
17		66	8	27	64	44	9	68	99	4	95					58		62		72	46	61	85	60	65	55	25	95	45	37	100		17	5
18	74	82	87	96	3	82	40	67	95	13	25	9	50	58		54	4		34	89	33	25	66	98	76	2	35	27	79	29	39	9	17	100
19	60	99	43	31	13	77	28	44	74	51	95	88			7	5	44		3	53	28		32	48	12	38	92	28	4			34	65	26
20	75	65	54	2	39	93	32	28	77	90	72	16	40	3	1	62	66	82	36	18	91	60	73	98	72	31	11	46	1	16	23	82	54	19
21	65	70	95	74	17	49	15	26	38	44	44	9	14	47	90	33	33	81	98	75	46	41	1	52	28	37	77	61	87	86	16	81	53	50
22	41	75	72	6	61	10	12	92	7	10	13	18	47	63	3	98	36	28	23	61	48	57	44	27	75	9	19	68	17	47	23	33	1	97
23	76	7	91	84	91	9	96	83	23	29	85	2	55	68	2	52	76	83	74	40	86	3	13	77	8	65	13	81	49	43	22	48	94	43
24	69	15	38	2	32	79	72	25	20	44	60	64	60	50	85	19	46	23	43	81	68	93	94	49	93	47	55	33	5	59	67	39	3	82
25	41		19	71	84	6	29	99	55	92	85					69	54	2		48	28	12		61	8	62	46	99	13	47	30	3	49	28
26	64	50	82	8	23	77	71	34	18	30	10	88	16	21	52	9	95	30	16	61	61	19	88	58	48	23	73	83	36	73	25	85	60	62
27	44	98	29	61	60	97	27	40	79	37	18		72				13				76	77		71	99	31	7	59	70	27	50	19	85	13
28	89	10	79	10	71	45	7	4	83	76	74	33	25	34	22		42		39	76	46	69	51	62	74	63	79	9	19	62	96	37	15	82
29	64	20	75	8	12	33	45	14	7	3	47	39	53		41			82		30	49	65	73	80	12	36	95	39	99	18	29	4	37	67
30	2	93	12	31	10	3	14	27	22	64	64	27	40	8		51		25			13	70	86	70	38	33	56	35	40	63	28	83	46	65
31 32	52 46	64 89	81 64	46 50	60	50	97 30	72 93	16 42	47 49	25 77	82 35						17		37 37		61 73	55 35	32 69	64 99	62 97	17 3	77 16	45	65 33	5 24	96 62	32 53	42 55
33		33	46	72	41 36	48 54	50	79	61			62		8	28		82		21		17	16	94	7	2	60	10	10	87 88	3	24	40	19	34
34		7	31	85	41	97	29	13	26	59	30	82					22			57		23	63	22	99	91	84	7	98	48	78	46	53	81
35	35	24	47	56		19	24	32		51									23	97	65	96	57	59	76	80	32	75	96	47	8	51	91	41
36	4	74	78	63	18	29	39	49		43			4			45				72		10		75	39	25	32	91	===			Ξ.	==	===
37	15	64	55				12		67					60							39	44	25	94	62	70	99	29		Tex	d 5	paces	: 4	O I
38	1	and the	To the Co		11/01	Co. amin	Tiesen S	30.00	Selection		1000	10.00	10000		0000	2000	marie.		1000	TO SECOND			October 1	1000	10.00	Table 1		350						
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	Threads.c		• 2			3			2-			2_1		× \ +			
1	200151	186615	197296	172846	172090	210218	173670	194525	174251	189519	200718	204405	202007	189732	183158	190252	196152
2	183762	194544	184577	182904	173253	196797	183443	182047	179425	177405	204076	181616	193052	180267	170731	184212	18597
3	195149	207973	189383	178277	185187	215388	178949	191444	181715	186927	194824	206412	212399	183738	171627	175226	19986
4	186464	217128	188345	185576	198794	222949	183032	192288	206610	184079	216768	212518	228499	199311	186593	190716	20791
5	184904	200085	196427	178034	181921	206089	172776	182871	196068	197254	200286	200799	192909	200199	193371	192303	19932
6	163869	181055	165433	161501	173187	186260	160389	181156	185083	171364	194457	183005	197227	180033	162286	179359	17603
7	182844	207256	196914	182686	192520	213395	183191	201705	180102	190657	194670	206741	223068	195737	194882	214377	20162
8	210877	231597	191207	210893	208814	230773	209336	221343	214012	213816	237686	224338	231863	217479	202382	222688	23842
9	205443	207762	204859	193007	202114	220213	200270	218954	185467	198664	209288	212024	221602	205146	197913	209254	20837
10	170951	190592	169835	172233	161288	200094	169173	177329	174427	172547	183009	176775	199588	166145	174741	174067	19060
11	160330	184780	167619	164429	160221	189431	164674	179150	169971	166495	196322	188807	198170	165885	151971	163314	17847
12	200261	210990	201781	184815	186232	207226	187861	200991	193031	192104	208854	195616	211685	199015	177808	187072	20069
13	179866	211201	189004	186859	180755	201781	186050	196049	192356	183889	206407	197907	201325	185296	172940	185859	20862
14	205200	234192	198286	185216	193523	213436	192149	204300	195962	203064	218522	220050	230363	212943	186929	199695	22063
15	192104	209607	205606	176570	192152	197059	197814	199654	184060	196239	195944	206127	205655	200638	185293	200306	21734
L6	219129	220315	212636	195126	199040	218061	209857	211543	208608	223702	224383	215732	225504	218944	200724	198602	23187
١7	203834	215665	218770	200210	197341	224700	204907	196265	200434	194902	229787	218805	214722	206631	183633	197228	21840
18	199346	213593	189097	184443	189471	213407	180741	182871	196068	199575	204990	209728	229011	193759	193496	200012	20034
19	203014	230250	210942	197880	194963	236386	200191	218228	212741	212129	237545	213988	223159	203015	195977	207420	21784
20	188328	215945	195572	189504	189264	210500	189695	187139	193349	188074	222493	209886	211959	193842	178970	213048	20012
21	201083	225154	200626	191389	199710	228640	194054	201351	203000	199014	219961	213679	227118	201564	192285	192620	22270
22	203655	212731	212923	186506	202917	213209	201835	196149	199936	198474	225703	203759	209807	195365	181268	204979	21260
23	221848	242617	205102	210088	203673	242426	211652	213238	224162	207129	239330	236334	234747	214832	196831	201668	22286
24	203404	225445	229553	202341	204464	238443	199668	204261	211167	223409	220172	214513	226025	206141	210855	205485	22773
25	211625	215862	205178	192633	196276	228741	188971	196269	195241	200894	202391	229214	218287	207189	188821	203107	22510
26	214580	236065	216746	200634	212626	226398	200132	208556	210833	199719	218000	216749	232425	222178	202483	224746	21903
27	192903	212967	195894	168036	197882	219733	192080	190050	186791	194178	195837	200053	201455	195183	194017	194406	21379
28	226021	221781	221406	217498	213727	232396	205057	223836	219484	215559	242115	232687	244996	223598	186498	225888	22961
29	186567	196259	177401	187171	188191	213347	200209	188691	192536	185900	209448	224470	211954	191139	174488	196498	21963
30	200958	218676	210822	193942	199082 190605	221415	189830	203355	201469	200398	217192	225167 223777	222696	195760 202282	199509	198748	20466
31 32	189114 212309	210222 223118	208021	199889 188479	206079	224878	198754 200814	190784 205121	206081	191457 210196	220213	229758	222325	202282	183234 207402	197522 214156	21009 22165
32 33	189068	2023118	186416	182441	175524	233523		180804		180984		202074		197941	174467	179508	20083
34	191164	210221	202944	178310	189694	213088	174126 202752	205923	195741 199845	191150	198382 199650	216831	209065 214870	203379	179104	184106	20063
35	164089	166881	171998	163977	155873	190526	159343	160631	162953	173034	183349	183331	195649	164554	168249	175749	16927
36	202159	226471	213812	191674	204015	227000	185290	207828	206861	199032	199682	211105	22225				
37	202159	220471	191774	192181	195488	22/000	189426	202643	199934	193357	234332	224227	2348( (23	39 Bytes)	10:1 Te:	d Spaces	s: 4 👸
38	200974	2200/1	191//4	192101	193400	220030	109426	202043	199954	19333/	234332	224221	23401				
Imn	nediate (Ja	ıvascri ×	Termir	nal													

183762   194544   184577   182944   173253   196797   183443   182047   179425   177405   2040476   181616   1939852   180267   179731   1	x (+)		2	× 2_		2_1	×		2-	×		3	×		• 2		Threads.c	13
195149   207973   189983   178277   185187   215388   178949   191444   18175   186927   194842   206412   212399   183738   171627   17814   181464   217128   188345   185576   198794   222949   183032   192288   206610   184079   216768   212518   228499   199111   186993   1716   1818494   200885   196427   178034   181921   206689   172776   182871   196686   197254   200286   200799   192909   200191   193371   178146   181849   207256   169643   181686   192526   131395   181156   181821   196657   194657   206741   223068   195737   194882   22384   223843   207762   208834   207752   208834   207752   208335   181158   181921   218386   237686   224338   231863   217479   202332   208343   207762   208459   193097   202134   202213   200270   218984   185467   196649   209288   212024   221602   205146   197913   20233   208344   207752   208383   18779   208383   208384   208775   208383   208384   2083833   208383   208383   208383   208383   208383   208383   208383   208383   208383   208383	0252 196152	190252	183158	189732	202007	204405	200718	189519	174251	194525	173670	210218	172090	172846	197296	186615	200151	1
186464   217128   188345   188576   198794   222949   183932   192288   266610   184079   216768   212518   228499   199311   186693   17136   183904   200808   1907275   182844   207256   196914   182666   192520   21395   183191   201705   180102   190657   194570   2006741   223668   195737   194882   22369   223197   223167   231957   191207   218083   208144   230773   200878   231937   231947   231946   231863   217479   203882   223196   231948   23073   231948   23073   231948   23073   231948   23073   231948   23073   231948   23073   231948   23073   231948   23073   231948   23073   231948   23073   231948   23073   231948   2319	4212 185974	184212	170731	180267							183443	196797	173253	182904	184577	194544	183762	2
S   184994   200805   196427   178034   181921   206809   172776   182871   196608   197254   200206   200799   1923073   12061   120610   120705   181912   190657   194670   206741   223068   195737   194882   228814   207255   195914   182686   195279   213395   183191   201705   180102   190657   194670   206741   223068   195737   194882   228814   23773   209336   221343   214012   213816   237686   224338   231863   217479   202382   228814   237673   209336   221343   214012   213816   237686   224338   231863   217479   202382   228814   236971   238936   238944   236971   238936   238944   236973   238944   236973   238944   236974   238984   236944   236988   212042   23698   236944   23698   236944   23698   236944   23698   236944   23698   236944   23698   236944   23698   236944   23698   236944   23698   236944   23698   236944   23698   236944   23698   236944   23698   236944   23698   236944   23698   236944   23698   236944   23698   236944   23698   236944   23698   236944   23698   23694   23698   236944   23694		175226	171627										185187	178277	189383	207973	195149	3
6 163869 181855 165433 161501 173187 186266 169389 181156 185983 171364 194457 183065 197227 180933 162286 17 18 182844 207256 196914 182686 195250 213395 183191 201705 180102 190657 194670 206741 223068 195737 194882 22 18 12047 231597 191107 210893 208814 230773 209336 221343 180102 131661 237686 24338 231863 217479 202382 22 10 170951 190592 169835 172233 161288 200904 169173 177329 174427 172547 183009 176775 199588 166145 174741 17 169330 184780 167619 164429 160221 189431 164674 179150 169971 166495 196322 188887 198170 165885 151971 11 169330 184780 167619 164429 160221 189431 164674 179150 169971 166495 196322 188887 198170 165885 151971 11 12 200261 201909 201781 184815 18622 207266 187861 200991 193101 192104 2088854 195616 211685 199015 177808 11 14 205200 234192 198286 185216 193523 213436 192149 204300 195962 203640 21822 220050 203633 212943 186929 17 191814 209607 205606 176570 192152 197659 197814 199554 184606 196239 195944 206127 205655 206038 185293 2 120142 20960 205606 176570 192152 197659 197814 199554 184606 196239 195944 206127 205655 206038 185293 2 120142 200500 200740 19704 20074		190716											198794		188345	217128	186464	4
Ray		192303														200085	184904	5
8 210877 231597 191207 210893 208814 230773 209336 221343 214012 213816 237686 224338 231863 217479 203382 22 10 17479 192181 196592 169835 172233 161288 20094 169173 177329 174427 172547 183009 176775 199588 166145 174741 11 160330 184780 167619 164429 160221 189431 164674 179150 160971 166495 196322 188807 198170 165885 151971 1 1 160330 184780 167619 164429 160221 189431 164674 179150 160971 166495 196322 188807 198170 165885 151971 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		179359														Section 1997	Section 1997	
Post443   207762   204859   193007   202114   220213   200209   218954   185467   198664   209288   212024   221602   205146   197913   20101   201015   200926   201518   200934   201512   200934   201513   201514   201513   201514   201513   201514   201513   201514   201513   201514   201513   201514   201513   201514   201513   201514   201513   201514   201513   201514   201513   201514   201513   201514   201513   201514   2		214377												182686	196914	207256	182844	7
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Immediate (Javascri x Terminal x +	ð																E	38