CPE 517 – LAB 4

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3. SUMMARY

FQMT :

```
#include <iostream>
#include <fstream>
#include <cstdlib>
#include "graph.h"
#include <chrono>

using namespace std::chrono;

int* BFSTraverse(graph<long, long, int, long, long, char>* ginst,int source){

		int frontier =0;
		int* statusArray = new int[ginst->vert_count];
		for (int i = 0; i < ginst->vert_count; i++)
			statusArray[i] = -1; //-1 means unvisited;

		int* currFrontierQueue = new int[ginst->vert_count];
		int* nextFrontierQueue = new int[ginst->vert_count];

		int currFrontierSize = 0;
		int nextFrontierSize = 0;

		currFrontierQueue[currFrontierSize] = source;
		currFrontierSize++;

		statusArray[source] = 0;
		int myFrontierIndex = 0;

		int currLevel = 1;

		while (true)
		{
			while (myFrontierIndex < currFrontierSize) {
				frontier = currFrontierQueue[myFrontierIndex];

				int beg = ginst->beg_pos[frontier];
				int end = ginst->beg_pos[frontier + 1];

				for (int j = beg; j < end; j++) {
					if (statusArray[ginst->csr[j]] == -1) {

						statusArray[ginst->csr[j]] = currLevel;
						nextFrontierQueue[nextFrontierSize] = ginst->csr[j];
						nextFrontierSize++;
					}
				}
				myFrontierIndex++;
			}

			if (nextFrontierSize == 0) {
				return statusArray;

			}

			//Swap current and next frontier queue;
			currFrontierSize = nextFrontierSize;
			myFrontierIndex = 0;
			nextFrontierSize = 0;

			int* temp = currFrontierQueue;
			currFrontierQueue = nextFrontierQueue;
			nextFrontierQueue = temp;
			currLevel++;
		}

}



int vect_add (int *a, int num){
		int res = 0;
		for (int i = 0; i < num; i ++){
			res += a[i];
		}
		return res;
}

int main(int args, char** argv)
{
		printf("Input: ./exe beg csr weight\n");

		if (args != 4) { std::cout << "Wrong input\n"; return -1; }

		//std::ofstream myfile;

		const char* beg_file = argv[1];
		const char* csr_file = argv[2];
		const char* weight_file = argv[3];

		graph<long, long, int, long, long, char>
			* ginst = new graph
			<long, long, int, long, long, char>
			(beg_file, csr_file, weight_file);

		int* statusArray = new int[ginst->vert_count];
```

FQST:

```
#include <iostream>
#include <fstream>
#include <cstdlib>
#include "graph.h"
#include <chrono>
using namespace std::chrono;
int* BFSTraverse(graph<long, long, int, long, long, char>* ginst,int source){
	int frontier =0;
	int* statusArray = new int[ginst->vert_count];
	for (int i = 0; i < ginst->vert_count; i++)
		statusArray[i] = -1; //-1 means unvisited;
	int* currFrontierQueue = new int[ginst->vert_count];
	int* nextFrontierQueue = new int[ginst->vert_count];
	int currFrontierSize = 0;
	int nextFrontierSize = 0;
	currFrontierQueue[currFrontierSize] = source;
	currFrontierSize++;
	statusArray[source] = 0;
	int myFrontierIndex = 0;
	int currLevel = 1;
	while (true)
	{
		while (myFrontierIndex < currFrontierSize) {
			frontier = currFrontierQueue[myFrontierIndex];
			int beg = ginst->beg_pos[frontier];
			int end = ginst->beg_pos[frontier + 1];
			for (int j = beg; j < end; j++) {
				if (statusArray[ginst->csr[j]] == -1) {
					statusArray[ginst->csr[j]] = currLevel;
					nextFrontierQueue[nextFrontierSize] = ginst->csr[j];
					nextFrontierSize++;
				}
			}
			myFrontierIndex++;
		}
		if (nextFrontierSize == 0) {
			return statusArray;
		}
```

```
                //Swap current and next frontier queue;
                currFrontierSize = nextFrontierSize;
                myFrontierIndex = 0;
                nextFrontierSize = 0;
                int* temp = currFrontierQueue;
                currFrontierQueue = nextFrontierQueue;
                nextFrontierQueue = temp;
                currLevel++;
        }
}
int vectadd (int *statusarray, int numCount){
        int r = 0;
        for (int i = 0; i < numCount; i++)
                r =r + statusarray[i];
        return r;
}

int main(int args, char** argv)
{
        printf("Input: ./exe beg csr weight\n");
        if (args != 4) {
      std::cout << "Enter correct input\n";
      return -1;
   }
        const char* beg = argv[1];
        const char* csr = argv[2];
        const char* weight = argv[3];
        graph<long, long, int, long, long, char>
                * ginst = new graph
                <long, long, int, long, long, char>
                (beg, csr, weight);
        int* statusArray = new int[ginst->vert_count];
        printf("Starting Frontier Queue Procedure\n");
        milliseconds start = duration_cast< milliseconds >(system_clock::now().time_since_epoch());
        statusArray = BFSTraverse(ginst, 0);
        int vect = vectadd(statusArray, ginst->vert_count);
        printf("%d\n",vect);
        milliseconds stop = duration_cast< milliseconds >(system_clock::now().time_since_epoch());
        printf("Duration = %lums\n" ,stop-start); }
```

SAMT:

```
#include <iostream>
#include <fstream>
#include <cstdlib>
#include "graph.h"
#include <omp.h>
#include <chrono>
using namespace std::chrono;
int* BFSTraverse2(graph<long, long, int, long, long, char>* ginst,int source){
	int* statusArray = new int[ginst->vert_count];
	for (int i = 0; i < ginst->vert_count; i++)
		statusArray[i] = -1; //-1 means unvisited;
	statusArray[source] = 0;
	int myFrontierCount = 0;
	int currLevel = 0;
	while (true){
		int ptr = 0;
		while (ptr < ginst->vert_count) {
			if (statusArray[ptr] == currLevel) {
				int beg = ginst->beg_pos[ptr];
				int end = ginst->beg_pos[ptr + 1];
				for (int j = beg; j < end; j++) {
					if (statusArray[ginst->csr[j]] == -1) {
						statusArray[ginst->csr[j]] = currLevel+1;
					}
				}
			}

			else if (statusArray[ptr] != currLevel) {
				myFrontierCount++;
			}
			ptr++;
		}
		currLevel++;

		if (myFrontierCount == ginst->vert_count) {
			return statusArray;
		}
		myFrontierCount = 0;
```

```
		}
}
int vectadd (int *a, int numCount, int tc){
		int r = 0;
		#pragma omp num_threads (tc)
		{
			int work_per_thread = numCount/tc;
			int my_thread_id = omp_get_thread_num();
			int my_beg = my_thread_id * work_per_thread;
			int my_end = my_beg + work_per_thread;
			int my_res = 0;

			//In case num cannot be evenly divided by thread_count
			if (my_thread_id == tc - 1){
				my_end = numCount;
			}
			while (my_beg < my_end){
				my_res += a[my_beg];
				my_beg ++;
			}
			__sync_fetch_and_add(&r, my_res);
		}
		return r;
}

int main(int args, char** argv){
		printf("Input: ./exe beg csr weight\n");
		if (args != 4)
	{
	   std::cout << "Wrong input\n";
	  return -1;
	}
		const char* beg = argv[1];
		const char* csr = argv[2];
		const char* weight = argv[3];
		graph<long, long, int, long, long, char>
			* ginst = new graph
			<long, long, int, long, long, char>
			(beg, csr, weight);
```

```
        int* statusArray = new int[ginst->vert_count];
        int thread_count = 0;
        printf("Enter Number of threads: ");
        std::cin>>thread_count;
        printf("Starting Frontier Queue Procedure\n");
        milliseconds start = duration_cast< milliseconds >(system_clock::now().time_since_epoch());
        statusArray = BFSTraverse2(ginst, 0);
        int vect = vectadd(statusArray, ginst->vert_count, thread_count);
        printf("%d\n",vect);
        milliseconds stop = duration_cast< milliseconds >(system_clock::now().time_since_epoch());
        printf("Duration = %lums\n", stop-start);

}
```

SAST:

```
#include <iostream>
#include <fstream>
#include <cstdlib>
#include "graph.h"
#include <chrono>

using namespace std::chrono;

int* BFSTraverse2(graph<long, long, int, long, long, char>* ginst,int source){

	int* statusArray = new int[ginst->vert_count];

	for (int i = 0; i < ginst->vert_count; i++)
		statusArray[i] = -1; //-1 means unvisited;

	statusArray[source] = 0;

	int myFrontierCount = 0;
	int currLevel = 0;

	while (true){
		int ptr = 0;

		while (ptr < ginst->vert_count) {
			if (statusArray[ptr] == currLevel) {

				int beg = ginst->beg_pos[ptr];
				int end = ginst->beg_pos[ptr + 1];
				for (int j = beg; j < end; j++) {
					if (statusArray[ginst->csr[j]] == -1) {
						statusArray[ginst->csr[j]] = currLevel+1;
					}
				}
			}

			else if (statusArray[ptr] != currLevel) {
				myFrontierCount++;
			}
```

```
                        ptr++;
                }
                currLevel++;

                if (myFrontierCount == ginst->vert_count) {
                        return statusArray;
                }
                myFrontierCount = 0;
        }
}

int vectadd(int *statusarray, int numCount){
        int r = 0;
        for (int i = 0; i < numCount; i ++)
                r =r+ statusarray[i];
        return r;
}

int main(int args, char** argv)
{
   printf("Input: ./exe beg csr weight\n");
        if (args != 4) { std::cout << "Enter Correct input\n"; return -1; }
        const char* beg = argv[1];
        const char* csr = argv[2];
        const char* weight = argv[3];
        graph<long, long, int, long, long, char>
                * ginst = new graph
                <long, long, int, long, long, char>
                (beg, csr, weight);
        int* statusArray = new int[ginst->vert_count];
        printf("Starting Procedure\n");
        milliseconds start = duration_cast< milliseconds >(system_clock::now().time_since_epoch());
        statusArray = BFSTraverse2(ginst, 0);
        int vect = vectadd(statusArray, ginst->vert_count);
        printf("%d\n",vect);
        milliseconds stop = duration_cast< milliseconds >(system_clock::now().time_since_epoch());
        printf("Duration = %lums\n", stop-start);
}
```

RESULTS:

Below the results are shown according to databases:

- Orkut
- YouTube
- Pokec
- LiveJournal

Orkut:

1. **FQST**

```
neelh@LAPTOP-6QGQ421H /home/Lab517
$ ./FQST.exe  ../graph_project_start/Graphs/Orkut/com-orkut.ungraph.txt_beg_pos.bin ../graph_project_start/Graphs/Orkut/
com-orkut.ungraph.txt_csr.bin  ../graph_project_start/Graphs/Orkut/com-orkut.ungraph.txt_weight.bin
Input: ./exe beg csr weight
Expected edge count: 234370180
234370180 234370180
Graph load (success): 117185084 verts, 234370180 edges 3.57894 second(s)
Starting Frontier Queue Procedure
-97951174
Duration = 2035ms
```

2. **SAST**

```
neelh@LAPTOP-6QGQ421H /home/Lab517
$ ./SAST.exe  ../graph_project_start/Graphs/Orkut/com-orkut.ungraph.txt_beg_pos.bin ../graph_project_start/Graphs/Orkut/
com-orkut.ungraph.txt_csr.bin  ../graph_project_start/Graphs/Orkut/com-orkut.ungraph.txt_weight.bin
Input: ./exe beg csr weight
Expected edge count: 234370180
234370180 234370180
Graph load (success): 117185084 verts, 234370180 edges 2.98604 second(s)
Starting Frontier Queue Procedure
-97951174
Duration = 4113ms
```

3. **FQMT**
   Thread Count = 1

```
neelh@LAPTOP-6QGQ421H /home/Lab517
$ ./FQMT.exe  ../graph_project_start/Graphs/Orkut/com-orkut.ungraph.txt_beg_pos.bin ../graph_project_start/Graphs/Orkut/
com-orkut.ungraph.txt_csr.bin  ../graph_project_start/Graphs/Orkut/com-orkut.ungraph.txt_weight.bin
Input: ./exe beg csr weight
Expected edge count: 234370180
234370180 234370180
Graph load (success): 117185084 verts, 234370180 edges 2.96561 second(s)
Enter Number of threads: 1
Starting Frontier Queue Procedure
-97951174
Duration = 2044ms
```

Thread Count = 2

```
neelh@LAPTOP-6QGQ421H /home/Lab517
$ ./FQMT.exe  ../graph_project_start/Graphs/Orkut/com-orkut.ungraph.txt_beg_pos.bin ../graph_project_start/Graphs/Orkut/
com-orkut.ungraph.txt_csr.bin  ../graph_project_start/Graphs/Orkut/com-orkut.ungraph.txt_weight.bin
Input: ./exe beg csr weight
Expected edge count: 234370180
234370180 234370180
Graph load (success): 117185084 verts, 234370180 edges 2.98462 second(s)
Enter Number of threads: 2
Starting Frontier Queue Procedure
-39358634
Duration = 1953ms
```

Thread Count = 4

```
neelh@LAPTOP-6QGQ421H /home/Lab517
$ ./FQMT.exe  ../graph_project_start/Graphs/Orkut/com-orkut.ungraph.txt_beg_pos.bin ../graph_project_start/Graphs/Orkut/
com-orkut.ungraph.txt_csr.bin  ../graph_project_start/Graphs/Orkut/com-orkut.ungraph.txt_weight.bin
Input: ./exe beg csr weight
Expected edge count: 234370180
234370180 234370180
Graph load (success): 117185084 verts, 234370180 edges 2.95489 second(s)
Enter Number of threads: 4
Starting Frontier Queue Procedure
-10062363
Duration = 1856ms
```

Thread Count = 8

4. **SAMT**

Thread Count = 1

```
neelh@LAPTOP-6QGQ421H /home/Lab517
$ ./SAMT.exe  ../graph_project_start/Graphs/Orkut/com-orkut.ungraph.txt_beg_pos.bin ../graph_project_start/Graphs/Orkut/
com-orkut.ungraph.txt_csr.bin  ../graph_project_start/Graphs/Orkut/com-orkut.ungraph.txt_weight.bin
Input: ./exe beg csr weight
Expected edge count: 234370180
234370180 234370180
Graph load (success): 117185084 verts, 234370180 edges 2.97068 second(s)
Enter Number of threads: 1
Starting Frontier Queue Procedure
-97951174
Duration = 4134ms
```

Thread Count = 2

```
neelh@LAPTOP-6QGQ421H /home/Lab517
$ ./SAMT.exe  ../graph_project_start/Graphs/Orkut/com-orkut.ungraph.txt_beg_pos.bin ../graph_project_start/Graphs/Orkut/
com-orkut.ungraph.txt_csr.bin  ../graph_project_start/Graphs/Orkut/com-orkut.ungraph.txt_weight.bin
Input: ./exe beg csr weight
Expected edge count: 234370180
234370180 234370180
Graph load (success): 117185084 verts, 234370180 edges 2.97503 second(s)
Enter Number of threads: 2
Starting Frontier Queue Procedure
-39358634
Duration = 3992ms
```

Thread Count = 4

```
neelh@LAPTOP-6QGQ421H /home/Lab517
$ ./SAMT.exe  ../graph_project_start/Graphs/Orkut/com-orkut.ungraph.txt_beg_pos.bin ../graph_project_start/Graphs/Orkut/
com-orkut.ungraph.txt_csr.bin  ../graph_project_start/Graphs/Orkut/com-orkut.ungraph.txt_weight.bin
Input: ./exe beg csr weight
Expected edge count: 234370180
234370180 234370180
Graph load (success): 117185084 verts, 234370180 edges 2.97758 second(s)
Enter Number of threads: 4
Starting Frontier Queue Procedure
-10062363
Duration = 3967ms
```

Thread Count = 8

```
neelh@LAPTOP-6QGQ421H /home/Lab517
$ ./SAMT.exe  ../graph_project_start/Graphs/Orkut/com-orkut.ungraph.txt_beg_pos.bin ../graph_project_start/Graphs/Orkut/
com-orkut.ungraph.txt_csr.bin  ../graph_project_start/Graphs/Orkut/com-orkut.ungraph.txt_weight.bin
Input: ./exe beg csr weight
Expected edge count: 234370180
234370180 234370180
Graph load (success): 117185084 verts, 234370180 edges 2.97187 second(s)
Enter Number of threads: 8
Starting Frontier Queue Procedure
4585773
Duration = 3914ms
```

Thread Count = 16

```
neelh@LAPTOP-6QGQ421H /home/Lab517
$ ./SAMT.exe  ../graph_project_start/Graphs/Orkut/com-orkut.ungraph.txt_beg_pos.bin ../graph_project_start/Graphs/Orkut/
com-orkut.ungraph.txt_csr.bin  ../graph_project_start/Graphs/Orkut/com-orkut.ungraph.txt_weight.bin
Input: ./exe beg csr weight
Expected edge count: 234370180
234370180 234370180
Graph load (success): 117185084 verts, 234370180 edges 2.99134 second(s)
Enter Number of threads: 16
Starting Frontier Queue Procedure
11909841
Duration = 3895ms
```

YouTube:

1. FQST

```
neelh@LAPTOP-6QGQ421H /home/Lab517
$ ./FQST.exe ../graph_project_start/Graphs/Youtube/com-youtube.ungraph.txt_beg_pos.bin ../graph_project_start/Graphs/You
tube/com-youtube.ungraph.txt_csr.bin ../graph_project_start/Graphs/Youtube/com-youtube.ungraph.txt_weight.bin
Input: ./exe beg csr weight
Expected edge count: 5975262
5975262 5975262
Graph load (success): 2987625 verts, 5975262 edges 0.0847621 second(s)
Starting Frontier Queue Procedure
4198273
Duration = 87ms
```

2. SAST

```
neelh@LAPTOP-6QGQ421H /home/Lab517
$ ./SAST.exe ../graph_project_start/Graphs/Youtube/com-youtube.ungraph.txt_beg_pos.bin ../graph_project_start/Graphs/You
tube/com-youtube.ungraph.txt_csr.bin ../graph_project_start/Graphs/Youtube/com-youtube.ungraph.txt_weight.bin
Input: ./exe beg csr weight
Expected edge count: 5975262
5975262 5975262
Graph load (success): 2987625 verts, 5975262 edges 0.0808771 second(s)
Starting Frontier Queue Procedure
4198273
Duration = 164ms
```

3. FQMT

Thread Count = 1

```
neelh@LAPTOP-6QGQ421H /home/Lab517
$ ./FQMT.exe ../graph_project_start/Graphs/Youtube/com-youtube.ungraph.txt_beg_pos.bin ../graph_project_start/Graphs/You
tube/com-youtube.ungraph.txt_csr.bin ../graph_project_start/Graphs/Youtube/com-youtube.ungraph.txt_weight.bin
Input: ./exe beg csr weight
Expected edge count: 5975262
5975262 5975262
Graph load (success): 2987625 verts, 5975262 edges 0.0811429 second(s)
Enter Number of threads: 1
Starting Frontier Queue Procedure
4198273
Duration = 85ms
```

Thread Count = 2

```
neelh@LAPTOP-6QGQ421H /home/Lab517
$ ./FQMT.exe ../graph_project_start/Graphs/Youtube/com-youtube.ungraph.txt_beg_pos.bin ../graph_project_start/Graphs/You
tube/com-youtube.ungraph.txt_csr.bin ../graph_project_start/Graphs/Youtube/com-youtube.ungraph.txt_weight.bin
Input: ./exe beg csr weight
Expected edge count: 5975262
5975262 5975262
Graph load (success): 2987625 verts, 5975262 edges 0.0791519 second(s)
Enter Number of threads: 2
Starting Frontier Queue Procedure
5692084
Duration = 88ms
```

Thread Count = 4

```
neelh@LAPTOP-6QGQ421H /home/Lab517
$ ./FQMT.exe ../graph_project_start/Graphs/Youtube/com-youtube.ungraph.txt_beg_pos.bin ../graph_project_start/Graphs/You
tube/com-youtube.ungraph.txt_csr.bin ../graph_project_start/Graphs/Youtube/com-youtube.ungraph.txt_weight.bin
Input: ./exe beg csr weight
Expected edge count: 5975262
5975262 5975262
Graph load (success): 2987625 verts, 5975262 edges 0.0776281 second(s)
Enter Number of threads: 4
Starting Frontier Queue Procedure
3716729
Duration = 79ms
```

Thread Count = 8

```
neelh@LAPTOP-6QGQ421H /home/Lab517
$ ./FQMT.exe ../graph_project_start/Graphs/Youtube/com-youtube.ungraph.txt_beg_pos.bin ../graph_project_start/Graphs/You
tube/com-youtube.ungraph.txt_csr.bin ../graph_project_start/Graphs/Youtube/com-youtube.ungraph.txt_weight.bin
Input: ./exe beg csr weight
Expected edge count: 5975262
5975262 5975262
Graph load (success): 2987625 verts, 5975262 edges 0.0775199 second(s)
Enter Number of threads: 8
Starting Frontier Queue Procedure
1792975
Duration = 77ms
```

Thread Count = 16

```
neelh@LAPTOP-6QGQ421H /home/Lab517
$ ./FQMT.exe ../graph_project_start/Graphs/Youtube/com-youtube.ungraph.txt_beg_pos.bin ../graph_project_start/Graphs/You
tube/com-youtube.ungraph.txt_csr.bin ../graph_project_start/Graphs/Youtube/com-youtube.ungraph.txt_weight.bin
Input: ./exe beg csr weight
Expected edge count: 5975262
5975262 5975262
Graph load (success): 2987625 verts, 5975262 edges 0.0781679 second(s)
Enter Number of threads: 16
Starting Frontier Queue Procedure
859651
Duration = 77ms
```

4. **SAMT**

Thread Count = 1

```
neelh@LAPTOP-6QGQ421H /home/Lab517
$ ./SAMT.exe ../graph_project_start/Graphs/Youtube/com-youtube.ungraph.txt_beg_pos.bin ../graph_project_start/Graphs/You
tube/com-youtube.ungraph.txt_csr.bin ../graph_project_start/Graphs/Youtube/com-youtube.ungraph.txt_weight.bin
Input: ./exe beg csr weight
Expected edge count: 5975262
5975262 5975262
Graph load (success): 2987625 verts, 5975262 edges 0.0814149 second(s)
Enter Number of threads: 1
Starting Frontier Queue Procedure
4198273
Duration = 167ms
```

Thread Count = 2

```
neelh@LAPTOP-6QGQ421H /home/Lab517
$ ./SAMT.exe ../graph_project_start/Graphs/Youtube/com-youtube.ungraph.txt_beg_pos.bin ../graph_project_start/Graphs/You
tube/com-youtube.ungraph.txt_csr.bin ../graph_project_start/Graphs/Youtube/com-youtube.ungraph.txt_weight.bin
Input: ./exe beg csr weight
Expected edge count: 5975262
5975262 5975262
Graph load (success): 2987625 verts, 5975262 edges 0.0781529 second(s)
Enter Number of threads: 2
Starting Frontier Queue Procedure
5692084
Duration = 167ms
```

Thread Count = 4

```
neelh@LAPTOP-6QGQ421H /home/Lab517
$ ./SAMT.exe ../graph_project_start/Graphs/Youtube/com-youtube.ungraph.txt_beg_pos.bin ../graph_project_start/Graphs/You
tube/com-youtube.ungraph.txt_csr.bin ../graph_project_start/Graphs/Youtube/com-youtube.ungraph.txt_weight.bin
Input: ./exe beg csr weight
Expected edge count: 5975262
5975262 5975262
Graph load (success): 2987625 verts, 5975262 edges 0.0792561 second(s)
Enter Number of threads: 4
Starting Frontier Queue Procedure
3716729
Duration = 166ms
```

Thread Count = 8

```
neelh@LAPTOP-6QGQ421H /home/Lab517
$ ./SAMT.exe ../graph_project_start/Graphs/Youtube/com-youtube.ungraph.txt_beg_pos.bin ../graph_project_start/Graphs/You
tube/com-youtube.ungraph.txt_csr.bin ../graph_project_start/Graphs/Youtube/com-youtube.ungraph.txt_weight.bin
Input: ./exe beg csr weight
Expected edge count: 5975262
5975262 5975262
Graph load (success): 2987625 verts, 5975262 edges 0.0793641 second(s)
Enter Number of threads: 8
Starting Frontier Queue Procedure
1792975
Duration = 162ms
```

Thread Count = 16

```
neelh@LAPTOP-6QGQ421H /home/Lab517
$ ./SAMT.exe ../graph_project_start/Graphs/Youtube/com-youtube.ungraph.txt_beg_pos.bin ../graph_project_start/Graphs/You
tube/com-youtube.ungraph.txt_csr.bin ../graph_project_start/Graphs/Youtube/com-youtube.ungraph.txt_weight.bin
Input: ./exe beg csr weight
Expected edge count: 5975262
5975262 5975262
Graph load (success): 2987625 verts, 5975262 edges 0.077318 second(s)
Enter Number of threads: 16
Starting Frontier Queue Procedure
859651
Duration = 160ms
```

Pokec:

1. **FQST**

```
neelh@LAPTOP-6QGQ421H /home/Lab517
$ ./FQST.exe ../graph_project_start/Graphs/Pokec/soc-pokec-relationships.txt_beg_pos.bin ../graph_project_start/Graphs/P
okec/soc-pokec-relationships.txt_csr.bin ../graph_project_start/Graphs/Pokec/soc-pokec-relationships.txt_weight.bin
Input: ./exe beg csr weight
Expected edge count: 61245128
61245128 61245128
Graph load (success): 1632803 verts, 61245128 edges 1.03434 second(s)
Starting Frontier Queue Procedure
7680932
Duration = 454ms
```

2. **SAST**

```
neelh@LAPTOP-6QGQ421H /home/Lab517
$ ./SAST.exe ../graph_project_start/Graphs/Pokec/soc-pokec-relationships.txt_beg_pos.bin ../graph_project_start/Graphs/P
okec/soc-pokec-relationships.txt_csr.bin ../graph_project_start/Graphs/Pokec/soc-pokec-relationships.txt_weight.bin
Input: ./exe beg csr weight
Expected edge count: 61245128
61245128 61245128
Graph load (success): 1632803 verts, 61245128 edges 0.641055 second(s)
Starting Frontier Queue Procedure
7680932
Duration = 297ms
```

3. **FQMT**

Thread Count = 1

```
neelh@LAPTOP-6QGQ421H /home/Lab517
$ ./FQMT.exe ../graph_project_start/Graphs/Pokec/soc-pokec-relationships.txt_beg_pos.bin ../graph_project_start/Graphs/P
okec/soc-pokec-relationships.txt_csr.bin ../graph_project_start/Graphs/Pokec/soc-pokec-relationships.txt_weight.bin
Input: ./exe beg csr weight
Expected edge count: 61245128
61245128 61245128
Graph load (success): 1632803 verts, 61245128 edges 0.652462 second(s)
Enter Number of threads: 1
Starting Frontier Queue Procedure
7680932
Duration = 443ms
```

Thread Count = 2

```
neelh@LAPTOP-6QGQ421H /home/Lab517
$ ./FQMT.exe ../graph_project_start/Graphs/Pokec/soc-pokec-relationships.txt_beg_pos.bin ../graph_project_start/Graphs/P
okec/soc-pokec-relationships.txt_csr.bin ../graph_project_start/Graphs/Pokec/soc-pokec-relationships.txt_weight.bin
Input: ./exe beg csr weight
Expected edge count: 61245128
61245128 61245128
Graph load (success): 1632803 verts, 61245128 edges 0.646407 second(s)
Enter Number of threads: 2
Starting Frontier Queue Procedure
3536090
Duration = 452ms
```

Thread Count = 4

```
neelh@LAPTOP-6QGQ421H /home/Lab517
$ ./FQMT.exe ../graph_project_start/Graphs/Pokec/soc-pokec-relationships.txt_beg_pos.bin ../graph_project_start/Graphs/P
okec/soc-pokec-relationships.txt_csr.bin ../graph_project_start/Graphs/Pokec/soc-pokec-relationships.txt_weight.bin
Input: ./exe beg csr weight
Expected edge count: 61245128
61245128 61245128
Graph load (success): 1632803 verts, 61245128 edges 0.636097 second(s)
Enter Number of threads: 4
Starting Frontier Queue Procedure
1669733
Duration = 446ms
```

Thread Count = 8

```
neelh@LAPTOP-6QGQ421H /home/Lab517
$ ./FQMT.exe ../graph_project_start/Graphs/Pokec/soc-pokec-relationships.txt_beg_pos.bin ../graph_project_start/Graphs/P
okec/soc-pokec-relationships.txt_csr.bin ../graph_project_start/Graphs/Pokec/soc-pokec-relationships.txt_weight.bin
Input: ./exe beg csr weight
Expected edge count: 61245128
61245128 61245128
Graph load (success): 1632803 verts, 61245128 edges 0.639832 second(s)
Enter Number of threads: 8
Starting Frontier Queue Procedure
791788
Duration = 437ms
```

Thread Count = 16

```
neelh@LAPTOP-6QGQ421H /home/Lab517
$ ./FQMT.exe ../graph_project_start/Graphs/Pokec/soc-pokec-relationships.txt_beg_pos.bin ../graph_project_start/Graphs/P
okec/soc-pokec-relationships.txt_csr.bin ../graph_project_start/Graphs/Pokec/soc-pokec-relationships.txt_weight.bin
Input: ./exe beg csr weight
Expected edge count: 61245128
61245128 61245128
Graph load (success): 1632803 verts, 61245128 edges 0.632628 second(s)
Enter Number of threads: 16
Starting Frontier Queue Procedure
385421
Duration = 438ms
```

4. **SAMT**

Thread Count = 1

```
neelh@LAPTOP-6QGQ421H /home/Lab517
$ ./SAMT.exe ../graph_project_start/Graphs/Pokec/soc-pokec-relationships.txt_beg_pos.bin ../graph_project_start/Graphs/P
okec/soc-pokec-relationships.txt_csr.bin ../graph_project_start/Graphs/Pokec/soc-pokec-relationships.txt_weight.bin
Input: ./exe beg csr weight
Expected edge count: 61245128
61245128 61245128
Graph load (success): 1632803 verts, 61245128 edges 0.639381 second(s)
Enter Number of threads: 1
Starting Frontier Queue Procedure
7680932
Duration = 305ms
```

Thread Count = 2

```
neelh@LAPTOP-6QGQ421H /home/Lab517
$ ./SAMT.exe ../graph_project_start/Graphs/Pokec/soc-pokec-relationships.txt_beg_pos.bin ../graph_project_start/Graphs/P
okec/soc-pokec-relationships.txt_csr.bin ../graph_project_start/Graphs/Pokec/soc-pokec-relationships.txt_weight.bin
Input: ./exe beg csr weight
Expected edge count: 61245128
61245128 61245128
Graph load (success): 1632803 verts, 61245128 edges 0.672387 second(s)
Enter Number of threads: 2
Starting Frontier Queue Procedure
3536090
Duration = 292ms
```

Thread Count = 4

```
neelh@LAPTOP-6QGQ421H /home/Lab517
$ ./SAMT.exe ../graph_project_start/Graphs/Pokec/soc-pokec-relationships.txt_beg_pos.bin ../graph_project_start/Graphs/P
okec/soc-pokec-relationships.txt_csr.bin ../graph_project_start/Graphs/Pokec/soc-pokec-relationships.txt_weight.bin
Input: ./exe beg csr weight
Expected edge count: 61245128
61245128 61245128
Graph load (success): 1632803 verts, 61245128 edges 0.634293 second(s)
Enter Number of threads: 4
Starting Frontier Queue Procedure
1669733
Duration = 294ms
```

Thread Count = 8

```
neelh@LAPTOP-6QGQ421H /home/Lab517
$ ./SAMT.exe ../graph_project_start/Graphs/Pokec/soc-pokec-relationships.txt_beg_pos.bin ../graph_project_start/Graphs/P
okec/soc-pokec-relationships.txt_csr.bin ../graph_project_start/Graphs/Pokec/soc-pokec-relationships.txt_weight.bin
Input: ./exe beg csr weight
Expected edge count: 61245128
61245128 61245128
Graph load (success): 1632803 verts, 61245128 edges 0.635393 second(s)
Enter Number of threads: 8
Starting Frontier Queue Procedure
791788
Duration = 289ms
```

Thread Count = 16

```
neelh@LAPTOP-6QGQ421H /home/Lab517
$ ./SAMT.exe ../graph_project_start/Graphs/Pokec/soc-pokec-relationships.txt_beg_pos.bin ../graph_project_start/Graphs/P
okec/soc-pokec-relationships.txt_csr.bin ../graph_project_start/Graphs/Pokec/soc-pokec-relationships.txt_weight.bin
Input: ./exe beg csr weight
Expected edge count: 61245128
61245128 61245128
Graph load (success): 1632803 verts, 61245128 edges 0.632426 second(s)
Enter Number of threads: 16
Starting Frontier Queue Procedure
385421
Duration = 292ms
```

LiveJournal

1. FQST

```
neelh@LAPTOP-6QGQ421H /home/Lab517
$ ./FQST.exe ../graph_project_start/Graphs/LiveJournal/com-lj.ungraph.txt_beg_pos.bin ../graph_project_start/Graphs/Live
Journal/com-lj.ungraph.txt_csr.bin ../graph_project_start/Graphs/LiveJournal/com-lj.ungraph.txt_weight.bin
Input: ./exe beg csr weight
Expected edge count: 69362392
69362392 69362392
Graph load (success): 34681190 verts, 69362392 edges 1.42972 second(s)
Starting Frontier Queue Procedure
-10549142
Duration = 913ms
```

2. SAST

```
neelh@LAPTOP-6QGQ421H /home/Lab517
$ ./SAST.exe ../graph_project_start/Graphs/LiveJournal/com-lj.ungraph.txt_beg_pos.bin ../graph_project_start/Graphs/Live
Journal/com-lj.ungraph.txt_csr.bin ../graph_project_start/Graphs/LiveJournal/com-lj.ungraph.txt_weight.bin
Input: ./exe beg csr weight
Expected edge count: 69362392
69362392 69362392
Graph load (success): 34681190 verts, 69362392 edges 0.894808 second(s)
Starting Frontier Queue Procedure
-10549142
Duration = 1721ms
```

3. FQMT

Thread Count = 1

```
neelh@LAPTOP-6QGQ421H /home/Lab517
$ ./FQMT.exe ../graph_project_start/Graphs/LiveJournal/com-lj.ungraph.txt_beg_pos.bin ../graph_project_start/Graphs/Live
Journal/com-lj.ungraph.txt_csr.bin ../graph_project_start/Graphs/LiveJournal/com-lj.ungraph.txt_weight.bin
Input: ./exe beg csr weight
Expected edge count: 69362392
69362392 69362392
Graph load (success): 34681190 verts, 69362392 edges 0.887695 second(s)
Enter Number of threads: 1
Starting Frontier Queue Procedure
-10549142
Duration = 932ms
```

Thread Count = 2

```
neelh@LAPTOP-6QGQ421H /home/Lab517
$ ./FQMT.exe ../graph_project_start/Graphs/LiveJournal/com-lj.ungraph.txt_beg_pos.bin ../graph_project_start/Graphs/Live
Journal/com-lj.ungraph.txt_csr.bin ../graph_project_start/Graphs/LiveJournal/com-lj.ungraph.txt_weight.bin
Input: ./exe beg csr weight
Expected edge count: 69362392
69362392 69362392
Graph load (success): 34681190 verts, 69362392 edges 0.883762 second(s)
Enter Number of threads: 2
Starting Frontier Queue Procedure
6791451
Duration = 885ms
```

Thread Count = 4

```
neelh@LAPTOP-6QGQ421H /home/Lab517
$ ./FQMT.exe ../graph_project_start/Graphs/LiveJournal/com-lj.ungraph.txt_beg_pos.bin ../graph_project_start/Graphs/Live
Journal/com-lj.ungraph.txt_csr.bin ../graph_project_start/Graphs/LiveJournal/com-lj.ungraph.txt_weight.bin
Input: ./exe beg csr weight
Expected edge count: 69362392
69362392 69362392
Graph load (success): 34681190 verts, 69362392 edges 0.879365 second(s)
Enter Number of threads: 4
Starting Frontier Queue Procedure
15461749
Duration = 880ms
```

Thread Count = 8

```
neelh@LAPTOP-6QGQ421H /home/Lab517
$ ./FQMT.exe ../graph_project_start/Graphs/LiveJournal/com-lj.ungraph.txt_beg_pos.bin ../graph_project_start/Graphs/Live
Journal/com-lj.ungraph.txt_csr.bin ../graph_project_start/Graphs/LiveJournal/com-lj.ungraph.txt_weight.bin
Input: ./exe beg csr weight
Expected edge count: 69362392
69362392 69362392
Graph load (success): 34681190 verts, 69362392 edges 0.878959 second(s)
Enter Number of threads: 8
Starting Frontier Queue Procedure
19796898
Duration = 854ms
```

Thread Count = 16

```
neelh@LAPTOP-6QGQ421H /home/Lab517
$ ./FQMT.exe ../graph_project_start/Graphs/LiveJournal/com-lj.ungraph.txt_beg_pos.bin ../graph_project_start/Graphs/Live
Journal/com-lj.ungraph.txt_csr.bin ../graph_project_start/Graphs/LiveJournal/com-lj.ungraph.txt_weight.bin
Input: ./exe beg csr weight
Expected edge count: 69362392
69362392 69362392
Graph load (success): 34681190 verts, 69362392 edges 0.871118 second(s)
Enter Number of threads: 16
Starting Frontier Queue Procedure
10148650
Duration = 863ms
```

4. SAMT

Thread Count = 1

```
neelh@LAPTOP-6QGQ421H /home/Lab517
$ ./SAMT.exe ../graph_project_start/Graphs/LiveJournal/com-lj.ungraph.txt_beg_pos.bin ../graph_project_start/Graphs/Live
Journal/com-lj.ungraph.txt_csr.bin ../graph_project_start/Graphs/LiveJournal/com-lj.ungraph.txt_weight.bin
Input: ./exe beg csr weight
Expected edge count: 69362392
69362392 69362392
Graph load (success): 34681190 verts, 69362392 edges 0.910406 second(s)
Enter Number of threads: 1
Starting Frontier Queue Procedure
-10549142
Duration = 1716ms
```

Thread Count = 2

```
neelh@LAPTOP-6QGQ421H /home/Lab517
$ ./SAMT.exe ../graph_project_start/Graphs/LiveJournal/com-lj.ungraph.txt_beg_pos.bin ../graph_project_start/Graphs/Live
Journal/com-lj.ungraph.txt_csr.bin ../graph_project_start/Graphs/LiveJournal/com-lj.ungraph.txt_weight.bin
Input: ./exe beg csr weight
Expected edge count: 69362392
69362392 69362392
Graph load (success): 34681190 verts, 69362392 edges 0.893059 second(s)
Enter Number of threads: 2
Starting Frontier Queue Procedure
6791451
Duration = 1692ms
```

Thread Count = 4

```
neelh@LAPTOP-6QGQ421H /home/Lab517
$ ./SAMT.exe ../graph_project_start/Graphs/LiveJournal/com-lj.ungraph.txt_beg_pos.bin ../graph_project_start/Graphs/Live
Journal/com-lj.ungraph.txt_csr.bin ../graph_project_start/Graphs/LiveJournal/com-lj.ungraph.txt_weight.bin
Input: ./exe beg csr weight
Expected edge count: 69362392
69362392 69362392
Graph load (success): 34681190 verts, 69362392 edges 0.894109 second(s)
Enter Number of threads: 4
Starting Frontier Queue Procedure
15461749
Duration = 1666ms
```

Thread Count = 8

```
neelh@LAPTOP-6QGQ421H /home/Lab517
$ ./SAMT.exe ../graph_project_start/Graphs/LiveJournal/com-lj.ungraph.txt_beg_pos.bin ../graph_project_start/Graphs/Live
Journal/com-lj.ungraph.txt_csr.bin ../graph_project_start/Graphs/LiveJournal/com-lj.ungraph.txt_weight.bin
Input: ./exe beg csr weight
Expected edge count: 69362392
69362392 69362392
Graph load (success): 34681190 verts, 69362392 edges 0.875885 second(s)
Enter Number of threads: 8
Starting Frontier Queue Procedure
19796898
Duration = 1651ms
```

Thread Count = 16

```
neelh@LAPTOP-6QGQ421H /home/Lab517
$ ./SAMT.exe ../graph_project_start/Graphs/LiveJournal/com-lj.ungraph.txt_beg_pos.bin ../graph_project_start/Graphs/Live
Journal/com-lj.ungraph.txt_csr.bin ../graph_project_start/Graphs/LiveJournal/com-lj.ungraph.txt_weight.bin
Input: ./exe beg csr weight
Expected edge count: 69362392
69362392 69362392
Graph load (success): 34681190 verts, 69362392 edges 0.880804 second(s)
Enter Number of threads: 16
Starting Frontier Queue Procedure
10148650
Duration = 1682ms
```

SUMMARY

	(ms)	(ms)	FQMT (ms)					SAMT (ms)				
Database/Method	**FQST**	**SQST**	**1**	**2**	**4**	**8**	**16**	**1**	**2**	**4**	**8**	**16**
Orkut	**2035**	**4113**	**2044**	**1953**	**1856**	**1865**	**1829**	**4134**	**3992**	**3967**	**3914**	**3895**
YouTube	**87**	**164**	**85**	**88**	**79**	**77**	**77**	**167**	**167**	**166**	**162**	**160**
Pokec	**454**	**297**	**443**	**452**	**446**	**437**	**438**	**305**	**292**	**294**	**289**	**292**
LiveJournal	**913**	**1721**	**932**	**885**	**880**	**854**	**863**	**1716**	**1672**	**1666**	**1651**	**1682**

Conclusion:
The conclusions that I could draw from this experiment was that:

- Different datasets have different characteristics.
- SAMT, SQST is slower than FQMT, FQST respectively, except for Pokec Dataset.