

CS 378 – Homework #4

Due Monday, Oct 27, Midnight

1 Graph Representations

Consider a graph for bfs which stores just enough data to compute bfs. Nodes have an integer distance label. Edges have no data. Implement both CSR and adjacency matrix representations of the graph.

2 BFS performance

Implement bfs (level labeling) and measure the performance and L1 cache misses for the two graph representations for at least the two inputs of different edge density listed below.

BFS can be implemented as, for a given start node "source":

```
initialize all node labels to infinity (or equivalent)
```

```
Queue Q;
```

```
Q.enqueue source
```

```
source.label = 0
```

```
while (not Q.empty) {  
    n = Q.pop  
    for each neighbor p of n {  
        if (p.label > n.label + 1) {  
            p.label = n.label + 1;  
            Q.enqueue p;  
        }  
    }  
}
```

To test, construct a graph which is a ring; node n has an edge to $n+1$ (and vice versa). The last node links to the first.

Second, construct a graph which is half connected (each node has an edge to approximately 1/2 of the other nodes). I don't care which nodes so long as the graph is connected.

Try graphs with at least 12000 nodes (about 1GB at 8 bytes per edge in adjacency matrix).

Turning in

Please write up your experiment and show the performance of the two graph representations on the two inputs. Turn in by email an archive (.zip or .tgz) to the TA.