CSE | 208

Data Structures & Algorithms II

(Sessional)

Basic Graph Algorithms

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**BFS Running Time**

|  |  |  |  |
| --- | --- | --- | --- |
| **Vertices** | **Edges** | **Adjacency Matrix**  **Runtime** | **Adjacency List Runtime** |
| 1000 | 1000 | 99700ns | 10300ns |
| 2000 | 2191000ns | 99700ns |
| 4000 | 2490100ns | 99700ns |
| 8000 | 2396500ns | 199500ns |
| 16000 | 2792500ns | 299200ns |
| 32000 | 2992000ns | 498700ns |
| 64000 | 3889200ns | 901100ns |
| 2000 | 2000 | 99700ns | 10300ns |
| 4000 | 7879100ns | 99700ns |
| 8000 | 8777000ns | 199400ns |
| 16000 | 8875300ns | 299200ns |
| 32000 | 8876200ns | 498700ns |
| 64000 | 9574500ns | 897600ns |
| 128000 | 10970400ns | 1795200ns |
| 256000 | 13962400ns | 3490700ns |
| 4000 | 4000 | 498400ns | 75900ns |
| 8000 | 34607300ns | 299200ns |
| 16000 | 34411600ns | 402700ns |
| 32000 | 34411600ns | 598600ns |
| 64000 | 34607400ns | 1000800ns |
| 128000 | 35309000ns | 1894900ns |
| 256000 | 37699300ns | 3591000ns |
| 512000 | 42685800ns | 7280400ns |
| 1024000 | 55052700ns | 13763100ns |
| 8000 | 8000 | 799200ns | 0ns |
| 16000 | 128260700ns | 498700ns |
| 32000 | 135936600ns | 900800ns |
| 64000 | 135940200ns | 1297200ns |
| 128000 | 136332500ns | 2294000ns |
| 256000 | 137532300ns | 3789500ns |
| 512000 | 140723700ns | 7280500ns |
| 1024000 | 149699800ns | 14360900ns |
| 2048000 | 171341900ns | 27426600ns |
| 4096000 | 219716200ns | 54154700ns |
| 16000 | 16000 | 598100ns | ns |
| 32000 | 510032800ns | 1096800ns |
| 64000 | 539357900ns | 1795200ns |
| 128000 | 540950600ns | 2693300ns |
| 256000 | 543741700ns | 4388300ns |
| 512000 | 548489200ns | 8178200ns |
| 1024000 | 548926700ns | 15557800ns |
| 2048000 | 562406500ns | 29122500ns |
| 4096000 | 595727500ns | 55451500ns |
| 8192000 | 683077600ns | 109606800ns |
| 16384000 | 878455000ns | 281048500ns |

**Question / Answers**

**Ques-1: What is the impact on runtime if we keep |V| unchanged and double |E| for adjacency list? Why is it so?**

The runtime for BFS on adjacency list is V + 2E. So, two conditions arise

1. if *|E| is very large compared to |V|,* then we see a significant increase in complexity.
2. if *|V| is close to or greater than |E|,* then we see no significant changes.

**Ques-2: What is the impact on runtime if we keep |E| unchanged and double |V| for adjacency list? Why is it so?**

The runtime for BFS on adjacency list is V + 2E. So, two conditions arise

1. if *|V| is very large compared to |E|,* then we see a significant increase in complexity.
2. if *|E| is close to or greater than |V|,* then we see no significant changes.

**Ques-3: What is the impact on runtime if we keep |V| unchanged and double |E| for adjacency matrix? Why is it so?**

The runtime for BFS on adjacency matrix is V 2. So, the runtime sees no change because |V| is not changed

**Ques-4: What is the impact on runtime if we keep |E| unchanged and double |V| for adjacency matrix? Why is it so?**

The runtime for BFS on adjacency matrix is V 2. So, there is significant increase in runtime due to increase in |V|, almost four times.

**Ques-5: For the same |E| and |V|, why are the runtimes for adjacency list and adjacency matrix representation different? Which one is higher and why?**

The runtime for BFS on adjacency matrix is V 2 and for adjacency list is V+2E. As the value of |V| increases we see greater increment in values for the matrix, because of the squared relationship but in case of list the increment is linear.