**División de Ingeniería**



**Departamento de Tecnologías de Información y Electrónica**

**Análisis y Diseño de Algoritmos (TC2017****)**

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# Ejercicios en Clase No. 2

### Algoritmos de Dijkstra y Floyd-Warshall

**1. Solución con Dijkstra**

| **Iteración 1** | | | | | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** |
| **D** | **∞** | **∞** | **0** | **∞** | **∞** | **∞** | **∞** | **∞** | **∞** | **∞** | **∞** | **∞** | **∞** | **∞** |
| **P** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** |

***Q = 1,2,3,4,5,6,7,8,9,10,11,12,13,14***

***S = 3***

***u = 3***

| **Iteración 2** | | | | | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** |
| **D** |  | 1 | 0 |  |  |  | 2 |  |  |  |  |  |  |  |
| **P** |  | 3 |  |  |  |  | 3 |  |  |  |  |  |  |  |

**Q = (1,4,5,6,7,8,9,10,11,12,13,14)**

**S = (3,2)**

**u = 2**

| **Iteración 3** | | | | | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** |
| **D** | 7 | 1 | 0 |  |  |  | 2 | 9 |  |  |  |  |  |  |
| **P** | 2 | 3 |  |  |  |  | 3 | 2 |  |  |  |  |  |  |

**Q = (1,4,5,6,8,9,10,11,12,13,14)**

**S = (3,2, 7)**

**u = 7**

| **Iteración 4** | | | | | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** |
| **D** | 7 | 1 | 0 |  |  | 6 | 2 | 5 |  |  |  |  |  | 4 |
| **P** | 2 | 3 |  |  |  | 7 | 3 | 7 |  |  |  |  |  | 7 |

**Q = (1,4,5,6,8,9,10,11,12,13)**

**S = (3,2,7, 14)**

**u = 14**

| **Iteración 5** | | | | | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** |
| **D** | 7 | 1 | 0 |  |  | 6 | 2 | 5 |  | 8 |  |  |  | 4 |
| **P** | 2 | 3 |  |  |  | 7 | 3 | 7 |  | 14 |  |  |  | 7 |

**Q = (1,4,5,6,9,10,11,12,13)**

**S = (3,2,7, 14, 8)**

**u = 8**

| **Iteración 6** | | | | | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** |
| **D** | 7 | 1 | 0 |  |  | 6 | 2 | 5 |  | 8 |  |  |  | 4 |
| **P** | 2 | 3 |  |  |  | 7 | 3 | 7 |  | 14 |  |  |  | 7 |

**Q = (1,4,5,9,10,11,12,13)**

**S = (3,2,7, 14, 8, 6)**

**u = 6**

| **Iteración 7** | | | | | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** |
| **D** | 7 | 1 | 0 |  |  | 6 | 2 | 5 | 15 | 8 |  |  |  | 4 |
| **P** | 2 | 3 |  |  |  | 7 | 3 | 7 | 6 | 14 |  |  |  | 7 |

**Q = (1,4,5,9,10,11,12,13)**

**S = (3,2,7, 14, 8, 6, 1)**

**u = 1**

| **Iteración 8** | | | | | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** |
| **D** | 7 | 1 | 0 | 14 | 16 | 6 | 2 | 5 | 15 | 8 |  |  |  | 4 |
| **P** | 2 | 3 |  | 1 | 1 | 7 | 3 | 7 | 6 | 14 |  |  |  | 7 |

**Q = (1,4,5,9,10,11,12,13)**

**S = (3,2,7, 14, 8, 6, 1, 10)**

**u = 10**

| **Iteración 9** | | | | | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** |
| **D** | 7 | 1 | 0 | 14 | 16 | 6 | 2 | 5 | 15 | 8 | 16 | 15 |  | 4 |
| **P** | 2 | 3 |  | 1 | 1 | 7 | 3 | 7 | 6 | 14 | 10 | 10 |  | 7 |

**Q = (1,5,9,11,12,13)**

**S = (3,2,7, 14, 8, 6, 1, 10, 4)**

**u = 4**

| **Iteración 10** | | | | | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** |
| **D** | 7 | 1 | 0 | 14 | 16 | 6 | 2 | 5 | 15 | 8 | 16 | 15 |  | 4 |
| **P** | 2 | 3 |  | 1 | 1 | 7 | 3 | 7 | 6 | 14 | 10 | 10 |  | 7 |

**Q = (1,5,11,12,13)**

**S = (3,2,7, 14, 8, 6, 1, 10, 4, 9)**

**u = 9**

| **Iteración 11** | | | | | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** |
| **D** | 7 | 1 | 0 | 14 | 16 | 6 | 2 | 5 | 15 | 8 | 16 | 15 |  | 4 |
| **P** | 2 | 3 |  | 1 | 1 | 7 | 3 | 7 | 6 | 14 | 10 | 10 |  | 7 |

**Q = (1,11,5,13)**

**S = (3,2,7, 14, 8, 6, 1, 10, 4, 9, 12)**

**u = 12**

| **Iteración 11** | | | | | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** |
| **D** | 7 | 1 | 0 | 14 | 16 | 6 | 2 | 5 | 15 | 8 | 16 | 15 |  | 4 |
| **P** | 2 | 3 |  | 1 | 1 | 7 | 3 | 7 | 6 | 14 | 10 | 10 |  | 7 |

**Q = (1,11,12,13)**

**S = (3,2,7, 14, 8, 6, 1, 10, 4, 9, 5)**

**u = 5**

| **Iteración 12** | | | | | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** |
| **D** | 7 | 1 | 0 | 14 | 16 | 6 | 2 | 5 | 15 | 8 | 16 | 15 |  | 4 |
| **P** | 2 | 3 |  | 1 | 1 | 7 | 3 | 7 | 6 | 14 | 10 | 10 |  | 7 |

**Q = (13)**

**S = (3,2,7, 14, 8, 6, 1, 10, 4, 9,12 , 5, 11)**

**u = 11**

| **Iteración 13** | | | | | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** |
| **D** | 7 | 1 | 0 | 14 | 16 | 6 | 2 | 5 | 15 | 8 | 16 | 15 | 18 | 4 |
| **P** | 2 | 3 |  | 1 | 1 | 7 | 3 | 7 | 6 | 14 | 10 | 10 | 11 | 7 |

**Q = ()**

**S = (3,2,7, 14, 8, 6, 1, 10, 4, 9, 12, 5, 11,13)**

**u = 13**

**2. Solución con Floyd-Warshall**

| **Después de iteración 1** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** |
| **1** | 0 | 6 |  | 10 |  |  |  |  |  |
| **2** | 6 | 0 | 5 | 16 | 10 |  |  |  |  |
| **3** |  | 5 | 0 |  |  |  |  |  |  |
| **4** | 10 | 16 |  | 0 | 9 |  | 5 |  |  |
| **5** |  | 10 |  | 9 | 0 |  |  |  | 2 |
| **6** |  |  |  |  |  | 0 |  | 5 | 1 |
| **7** |  |  |  | 5 |  |  | 0 | 4 |  |
| **8** |  |  |  |  |  | 5 | 4 | 0 |  |
| **9** |  |  |  |  | 2 | 1 |  |  | 0 |

| **Después de iteración 2** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** |
| **1** | 0 | 6 | 11 | 10 | 16 |  |  |  |  |
| **2** | 6 | 0 | 5 | 16 | 10 |  |  |  |  |
| **3** | 11 | 5 | 0 | 21 | 15 |  |  |  |  |
| **4** | 10 | 16 | 21 | 0 | 9 |  | 5 |  |  |
| **5** | 16 | 10 | 15 | 9 | 0 |  |  |  | 2 |
| **6** |  |  |  |  |  | 0 |  | 5 | 1 |
| **7** |  |  |  | 5 |  |  | 0 | 4 |  |
| **8** |  |  |  |  |  | 5 | 4 | 0 |  |
| **9** |  |  |  |  | 2 | 1 |  |  | 0 |

| **Después de iteración 3** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** |
| **1** | 0 | 6 | 11 | 10 | 16 |  |  |  |  |
| **2** | 6 | 0 | 5 | 16 | 10 |  |  |  |  |
| **3** | 11 | 5 | 0 | 21 | 15 |  |  |  |  |
| **4** | 10 | 16 | 21 | 0 | 9 |  | 5 |  |  |
| **5** | 16 | 10 | 15 | 9 | 0 |  |  |  | 2 |
| **6** |  |  |  |  |  | 0 |  | 5 | 1 |
| **7** |  |  |  | 5 |  |  | 0 | 4 |  |
| **8** |  |  |  |  |  | 5 | 4 | 0 |  |
| **9** |  |  |  |  | 2 | 1 |  |  | 0 |

| **Después de iteración 4** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** |
| **1** | 0 | 6 | 11 | 10 | 16 |  | 15 |  |  |
| **2** | 6 | 0 | 5 | 16 | 10 |  |  |  |  |
| **3** | 11 | 5 | 0 | 21 | 15 |  |  |  |  |
| **4** | 10 | 16 | 21 | 0 | 9 |  | 5 |  |  |
| **5** | 16 | 10 | 15 | 9 | 0 |  |  |  | 2 |
| **6** |  |  |  |  |  | 0 |  | 5 | 1 |
| **7** | 15 |  |  | 5 |  |  | 0 | 4 |  |
| **8** |  |  |  |  |  | 5 | 4 | 0 |  |
| **9** |  |  |  |  | 2 | 1 |  |  | 0 |

| **Después de iteración 5** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** |
| **1** | 0 |  |  |  |  |  |  |  |  |
| **2** |  | 0 |  |  |  |  |  |  |  |
| **3** |  |  | 0 |  |  |  |  |  |  |
| **4** |  |  |  | 0 |  |  |  |  |  |
| **5** |  |  |  |  | 0 |  |  |  |  |
| **6** |  |  |  |  |  | 0 |  |  |  |
| **7** |  |  |  |  |  |  | 0 |  |  |
| **8** |  |  |  |  |  |  |  | 0 |  |
| **9** |  |  |  |  |  |  |  |  | 0 |

| **Después de iteración 6** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** |
| **1** | 0 |  |  |  |  |  |  |  |  |
| **2** |  | 0 |  |  |  |  |  |  |  |
| **3** |  |  | 0 |  |  |  |  |  |  |
| **4** |  |  |  | 0 |  |  |  |  |  |
| **5** |  |  |  |  | 0 |  |  |  |  |
| **6** |  |  |  |  |  | 0 |  |  |  |
| **7** |  |  |  |  |  |  | 0 |  |  |
| **8** |  |  |  |  |  |  |  | 0 |  |
| **9** |  |  |  |  |  |  |  |  | 0 |

| **Después de iteración 7** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** |
| **1** | 0 |  |  |  |  |  |  |  |  |
| **2** |  | 0 |  |  |  |  |  |  |  |
| **3** |  |  | 0 |  |  |  |  |  |  |
| **4** |  |  |  | 0 |  |  |  |  |  |
| **5** |  |  |  |  | 0 |  |  |  |  |
| **6** |  |  |  |  |  | 0 |  |  |  |
| **7** |  |  |  |  |  |  | 0 |  |  |
| **8** |  |  |  |  |  |  |  | 0 |  |
| **9** |  |  |  |  |  |  |  |  | 0 |

| **Después de iteración 8** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** |
| **1** | 0 |  |  |  |  |  |  |  |  |
| **2** |  | 0 |  |  |  |  |  |  |  |
| **3** |  |  | 0 |  |  |  |  |  |  |
| **4** |  |  |  | 0 |  |  |  |  |  |
| **5** |  |  |  |  | 0 |  |  |  |  |
| **6** |  |  |  |  |  | 0 |  |  |  |
| **7** |  |  |  |  |  |  | 0 |  |  |
| **8** |  |  |  |  |  |  |  | 0 |  |
| **9** |  |  |  |  |  |  |  |  | 0 |

| **Después de iteración 9** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** |
| **1** | 0 |  |  |  |  |  |  |  |  |
| **2** |  | 0 |  |  |  |  |  |  |  |
| **3** |  |  | 0 |  |  |  |  |  |  |
| **4** |  |  |  | 0 |  |  |  |  |  |
| **5** |  |  |  |  | 0 |  |  |  |  |
| **6** |  |  |  |  |  | 0 |  |  |  |
| **7** |  |  |  |  |  |  | 0 |  |  |
| **8** |  |  |  |  |  |  |  | 0 |  |
| **9** |  |  |  |  |  |  |  |  | 0 |