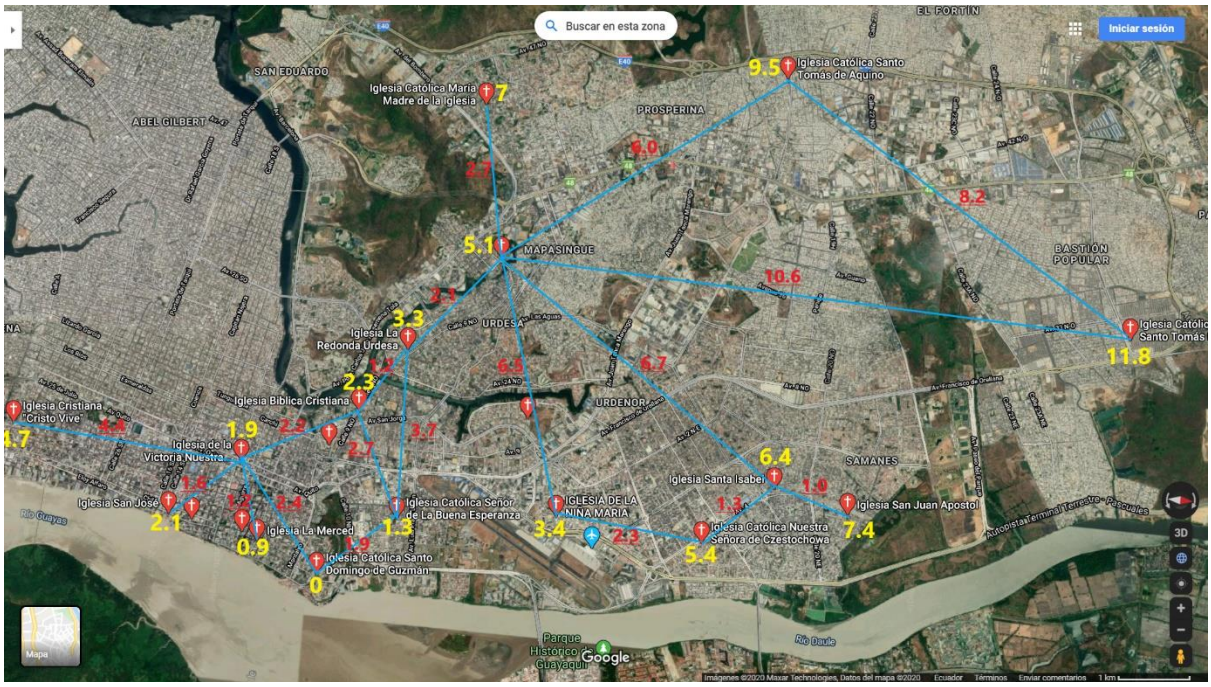
Objetivo:

- Consolidar los conocimientos adquiridos en clase para los metodos de busqueda heuristicos.

Enunciado:

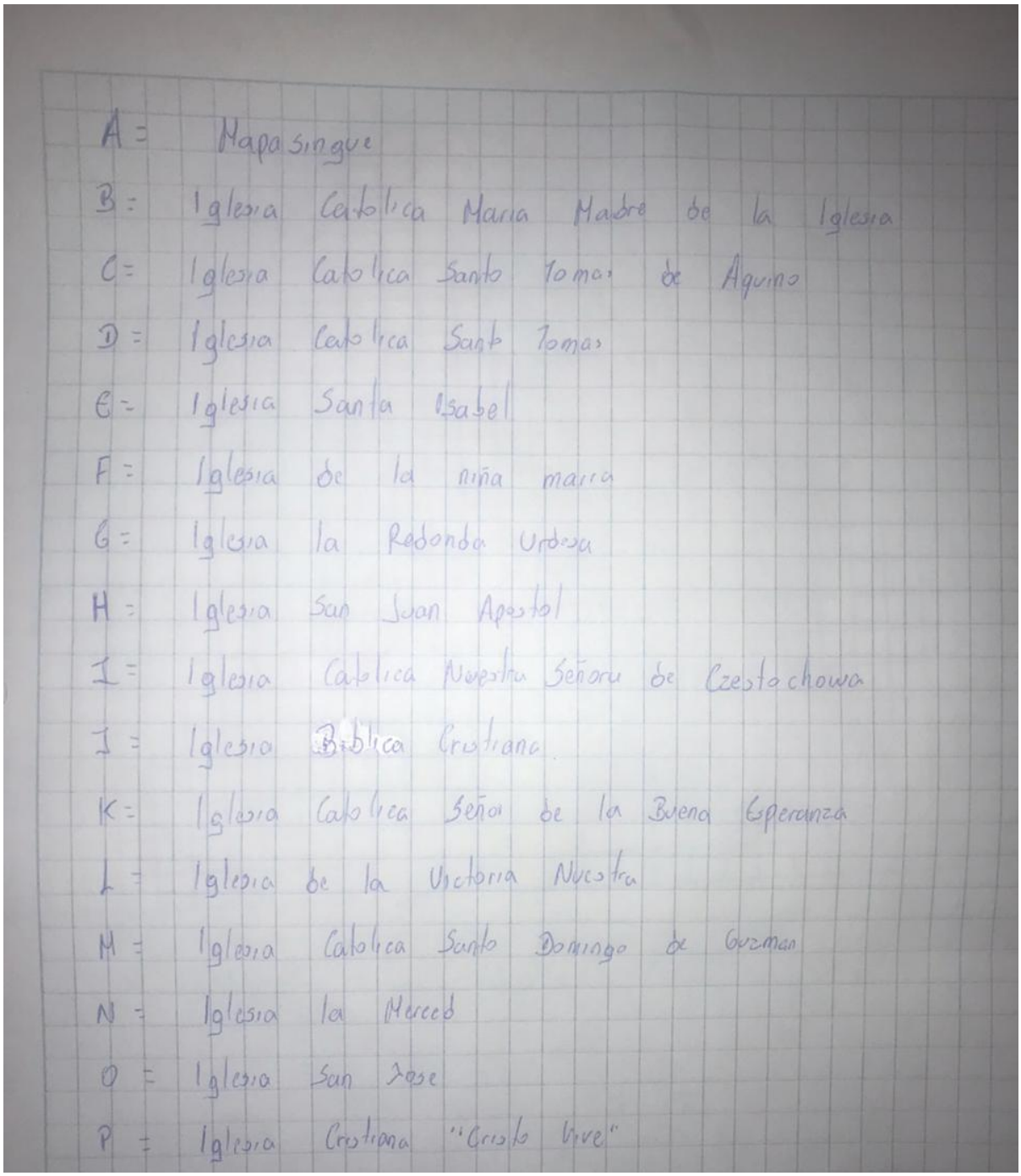
- Diseñe y desarrolle un mapa de nodos para encontrar la ruta mas corta de la iglesia central de cada ciudad a la iglesia mas alejada para ello se debe seguir los siguientes pasos :
  Se tiene los datos dentro de Google Maps (https://www.google.com/maps/search/iglesias/@-2.891806,-79.0135548,14.13z), generar y agregar un captura de pantalla de la busqueda y generacion de los mapas: **Ciudad: Guayas.**
  ◦
    - Agregar un grafico con los nodos conformados al menos cada nodo debe tener tres o mas hijos.
    - Generar un arbol de nodos que represente los datos del mapa para realizar la busqueda.
    - Agregar el tipo de medida, ademas de tomar los datos h(n) = Medicion con la herramienta de regla Google, g(n)= Costo de llegar con vehiculo.

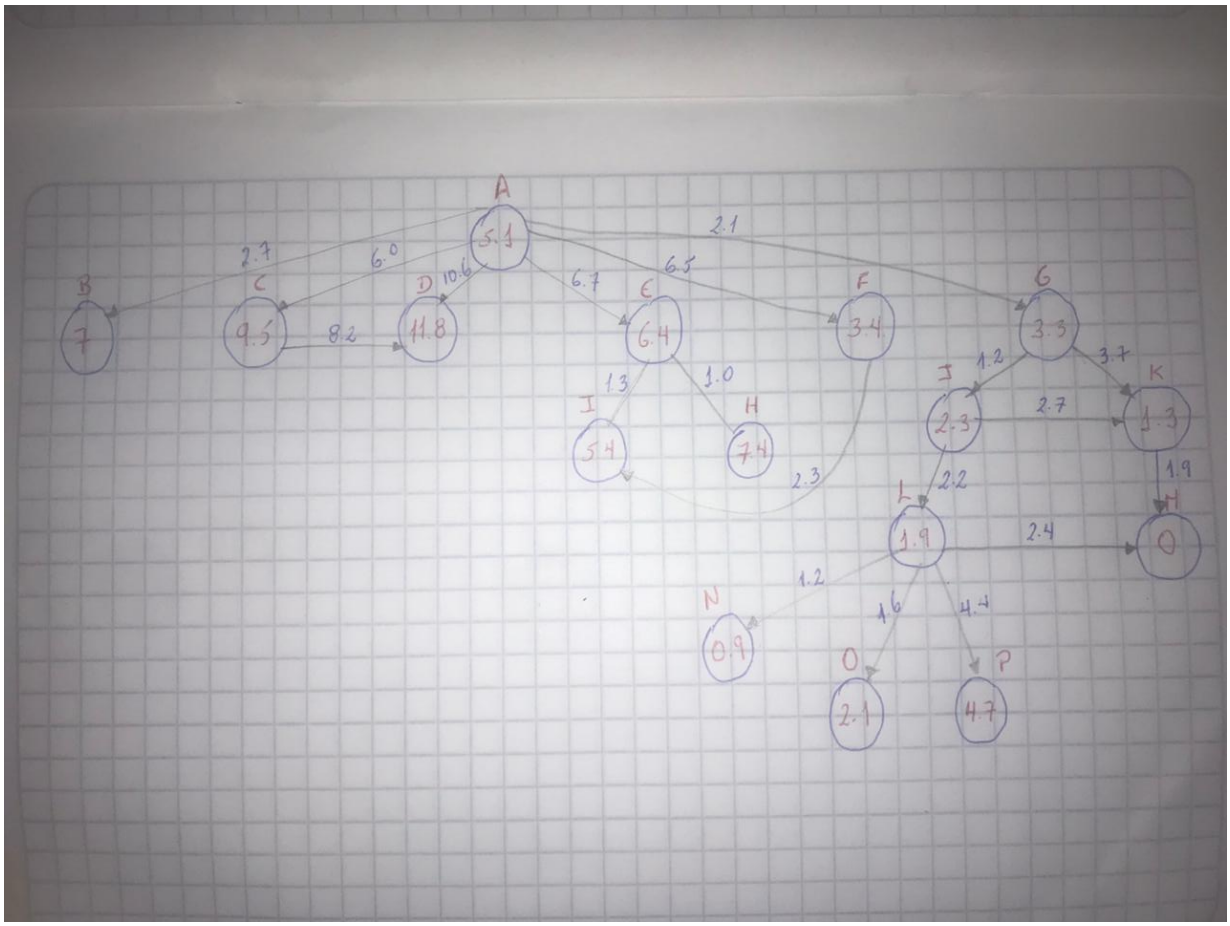


h(n) de color amarillo
g(n) de color rojo

La medida es en KILOMETROS

- Realizar la busqueda por A* (Manualmente)




A
5.1
B
7
2.7
C
9.5
6.0
8.2
D
11.8
10.6
6.7
E
6.4
6.5
F
3.4
2.1
G
3.3
I
5.4
1.3
H
7.4
1.0
2.3
I
2.3
1.2
3.7
K
1.3
2.7
1.9
H
0
L
1.9
2.2
2.4
1.2
N
0.9
1.6
4.4
O
2.1
P
4.7

INICIO = A
META = M

1. Cola = { G(5.4) ; B(9.7) ; F(9.9) ; E(13.1) ; C(15.5) ; D(22.4) }
   Visitados = { A(0) }

2. Cola = { J(5.6) ; K(7.1) ; B(9.7) ; F(9.9) ; E(13.1) ; C(15.5) ; D(22.4) }
   Visitados = { A(0) ; G(5.4) }

3. Cola = { K(7.1) ; L(7.4) ; B(9.7) ; F(9.9) ; E(13.1) ; C(15.5) ; D(22.4) }

   Visitados = { A(0) ; G(5.4) ; J(5.6) }

3. Cola { M=(7.7) ; K(7.4) ; B(9.7) ; F(9.9) ; E(13.1) ; C(15.5) ; D(22.4) }
   Visitados = { A(0) ; G(5.4) ; J(5.6) ; K(7.1) }

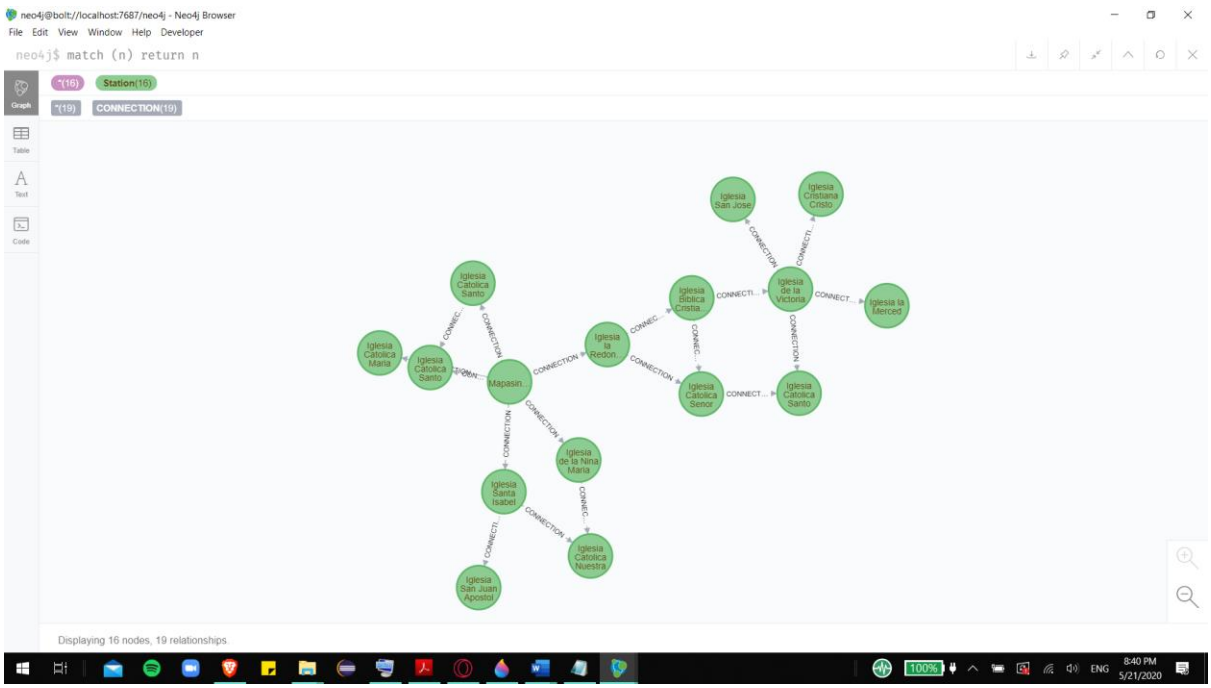
   Aquí como ya se llego al nodo Meta no se realizan mas pasos

   Ruta = A → G → K → M
   Costo = 7.7

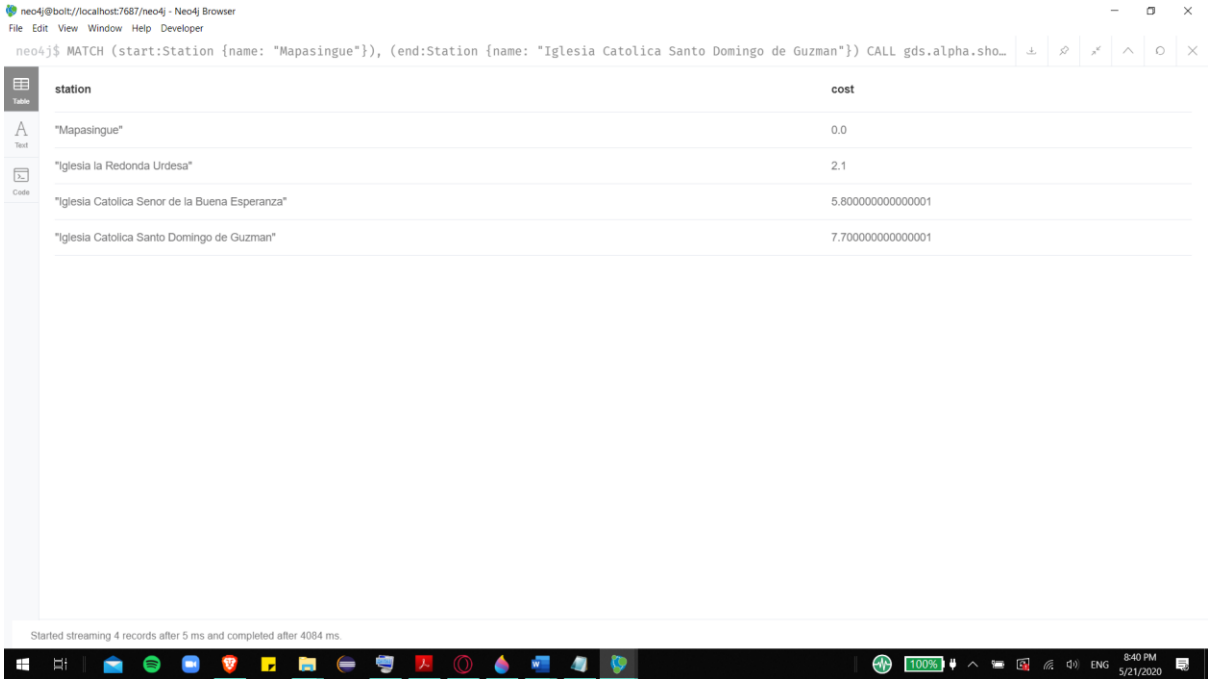
- Programar y presentar los resultados mediante los algoritmos de búsqueda en Neo4j (A*)

```
CREATE (a:Station {name: 'Mapasingue', latitude: 2.163280, longitude: -79.919983}),
    (b:Station {name: 'Iglesia Catolica Maria Madre de la Iglesia', latitude: -2.167238, longitude: -79.938714}),
    (c:Station {name: 'Iglesia Catolica Santo Tomas de Aquino', latitude: -2.129314, longitude: -79.945655}),
    (d:Station {name: 'Iglesia Catolica Santo Tomas', latitude: -2.082948, longitude: -79.917121}),
    (e:Station {name: 'Iglesia Santa Isabel', latitude: -2.125842, longitude: -79.893924}),
    (f:Station {name: 'Iglesia de la Nina Maria', latitude: -2.152932, longitude: -79.887695}),
    (g:Station {name: 'Iglesia la Redonda Urdesa', latitude: -2.173630, longitude: -79.906897}),
    (h:Station {name: 'Iglesia San Juan Apostol', latitude: -2.116310, longitude: -79.891654}),
    (i:Station {name: 'Iglesia Catolica Nuestra Senora de Czestochowa', latitude: -2.134286, longitude: -79.886210}),
    (j:Station {name: 'Iglesia Biblica Cristiana', latitude: -2.179037, longitude: -79.898537}),
    (k:Station {name: 'Iglesia Catolica Senor de la Buena Esperanza', latitude: -2.172930, longitude: -79.885459}),
    (l:Station {name: 'Iglesia de la Victoria Nuestra', latitude: -2.193211, longitude: 79.890767}),
    (m:Station {name: 'Iglesia Catolica Santo Domingo de Guzman', latitude: -2.181941, longitude: -79.878106}),
    (n:Station {name: 'Iglesia la Merced', latitude: -2.190085, longitude: -79.881033}),
    (o:Station {name: 'Iglesia San Jose', latitude: -2.201760, longitude: -79.883361}),
    (p:Station {name: 'Iglesia Cristiana Cristo Vive', latitude: -2.222465, longitude: -79.892814}),
    (a)-[:CONNECTION {time: 2.7}]->(b),
    (a)-[:CONNECTION {time: 6.0}]->(c),
    (a)-[:CONNECTION {time: 10.6}]->(d),
    (a)-[:CONNECTION {time: 6.7}]->(e),
    (a)-[:CONNECTION {time: 6.5}]->(f),
    (a)-[:CONNECTION {time: 2.1}]->(g),
    (c)-[:CONNECTION {time: 8.2}]->(d),
    (e)-[:CONNECTION {time: 1.0}]->(h),
```

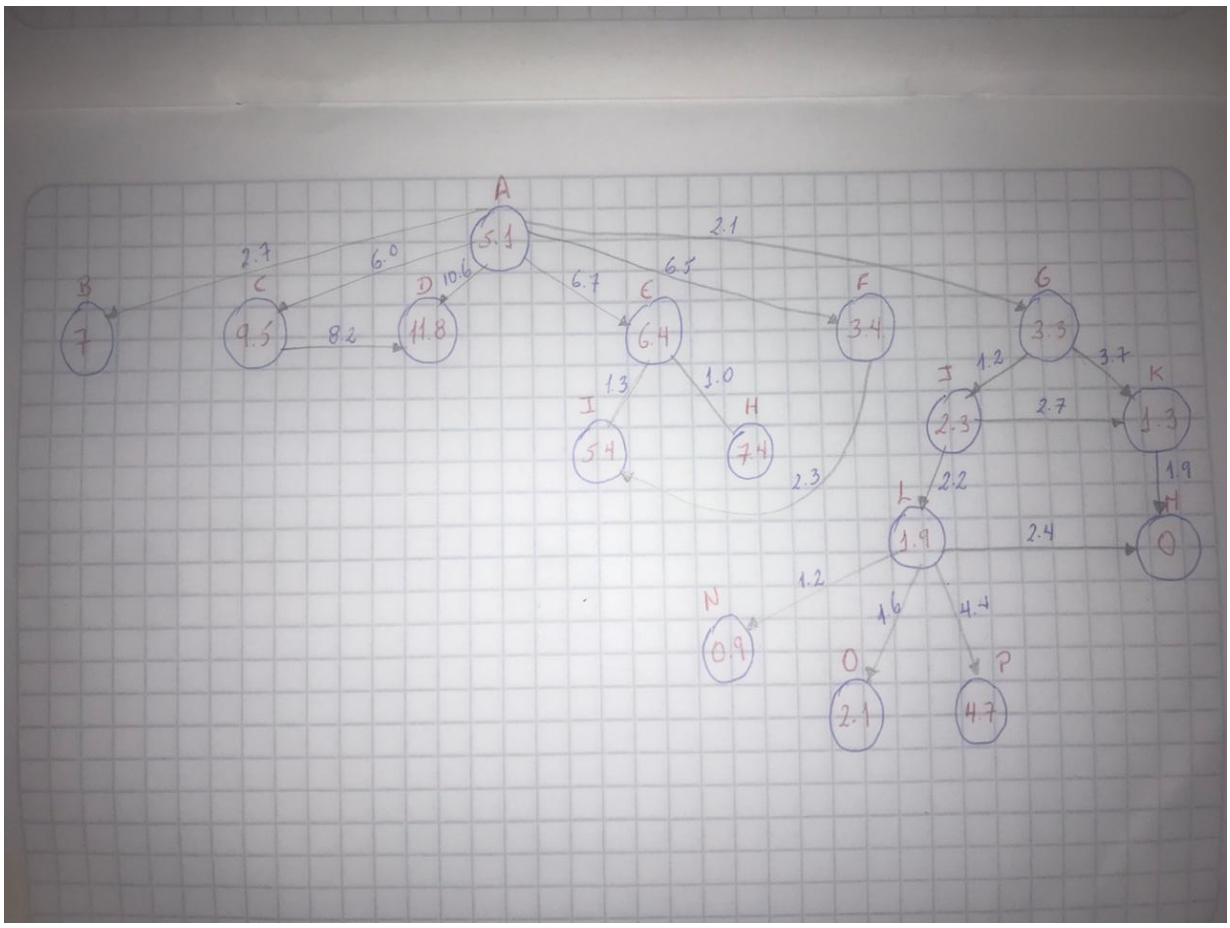
(e)-[:CONNECTION {time: 1.3}]->(i),
(f)-[:CONNECTION {time: 2.3}]->(i),
(g)-[:CONNECTION {time: 1.2}]->(j),
(g)-[:CONNECTION {time: 3.7}]->(k),
(j)-[:CONNECTION {time: 2.7}]->(k),
(j)-[:CONNECTION {time: 2.2}]->(l),
(k)-[:CONNECTION {time: 1.9}]->(m),
(l)-[:CONNECTION {time: 1.2}]->(n),
(l)-[:CONNECTION {time: 1.6}]->(o),
(l)-[:CONNECTION {time: 4.4}]->(p),
(l)-[:CONNECTION {time: 2.4}]->(m)

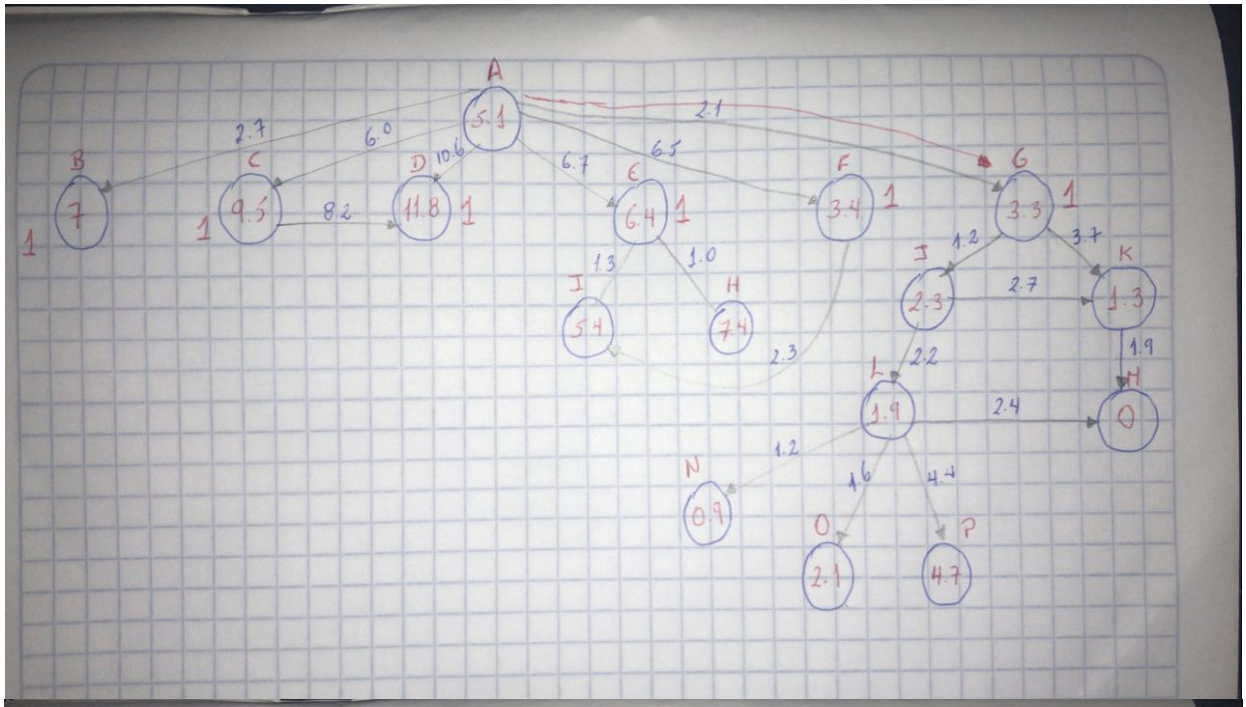



```
MATCH (start:Station {name: "Mapasingue"}), (end:Station {name: "Iglesia Catolica Santo Domingo de Guzman"})
CALL gds.alpha.shortestPath.astar.stream({
  nodeQuery: 'MATCH (p:Station) RETURN id(p) AS id',
  relationshipQuery: 'MATCH (p1:Station)-[r:CONNECTION]->(p2:Station) RETURN id(p1) AS source, id(p2) AS target, r.time AS weight',
  startNode: start,
  endNode: end,
  relationshipWeightProperty: 'weight',
  propertyKeyLat: 'latitude',
  propertyKeyLat: 'longitude'
})
YIELD nodeId, cost
RETURN gds.util.asNode(nodeId).name AS station, cost
```


neo4j@bolt://localhost:7687/neo4j - Neo4j Browser
File Edit View Window Help Developer
neo4j$ MATCH (start:Station {name: "Mapasingue"}), (end:Station {name: "Iglesia Catolica Santo Domingo de Guzman"}) CALL gds.alpha.sho…
Table
Text
Code
station
cost
"Mapasingue"
0.0
"Iglesia la Redonda Urdesa"
2.1
"Iglesia Catolica Senor de la Buena Esperanza"
5.800000000000001
"Iglesia Catolica Santo Domingo de Guzman"
7.700000000000001
Started streaming 4 records after 5 ms and completed after 4084 ms.
100%
ENG
8:40 PM
5/21/2020

- Realizar la búsqueda de Ascenso por colinas h(n) (Manualmente).




A
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2.7
6.0
10.6
8.2
6.7
6.5
2.1
1.3
1.0
1.2
3.7
2.7
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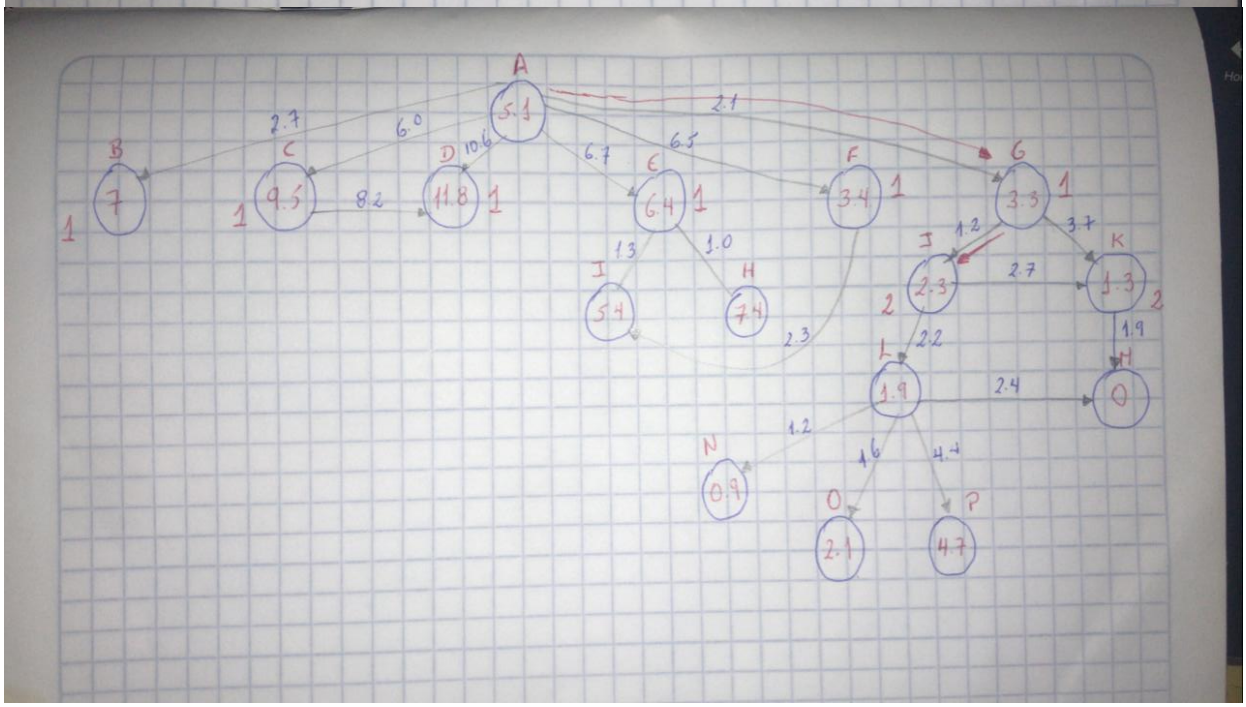
A
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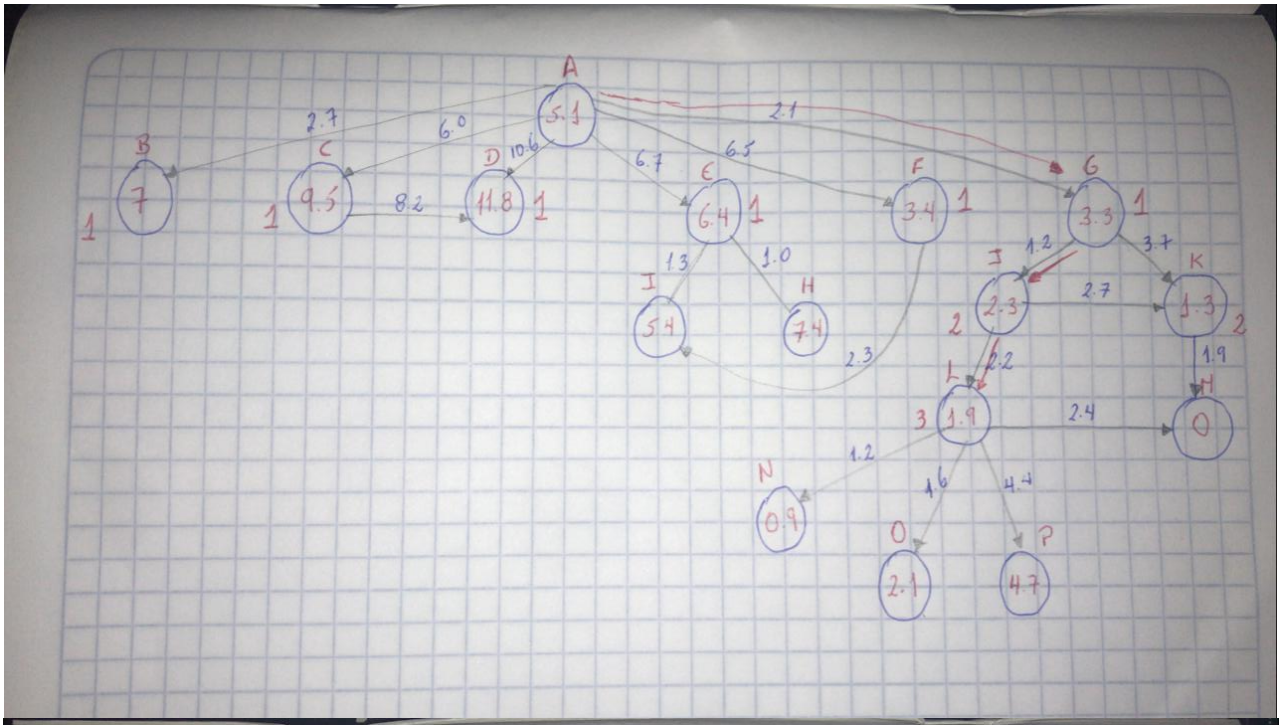
6.5
2.1
1.3
1.0
1.2
3.7
2.7
1.9
2.3
2.2
2.4
1.2
1.6
4.4
1
1
1
1
1
1
1
2
2


A
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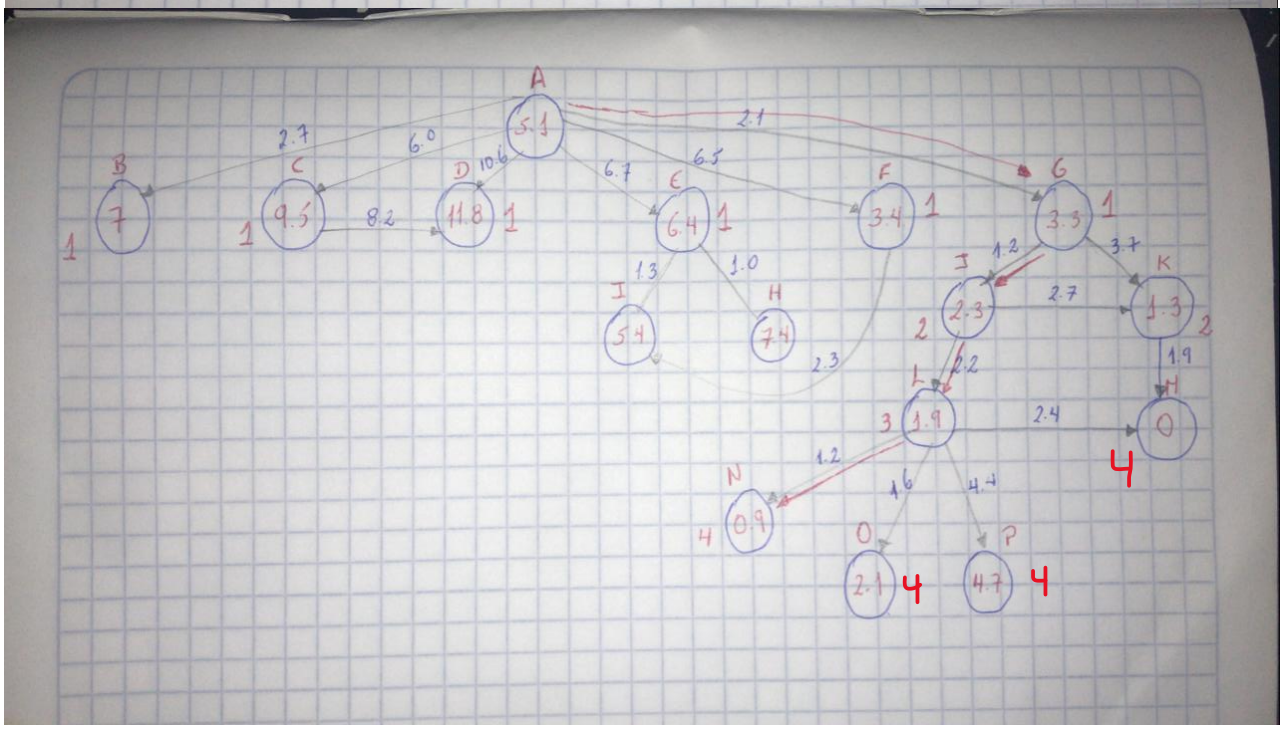
A
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10.6
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2.3
1.2
3.7
2.7
1.9
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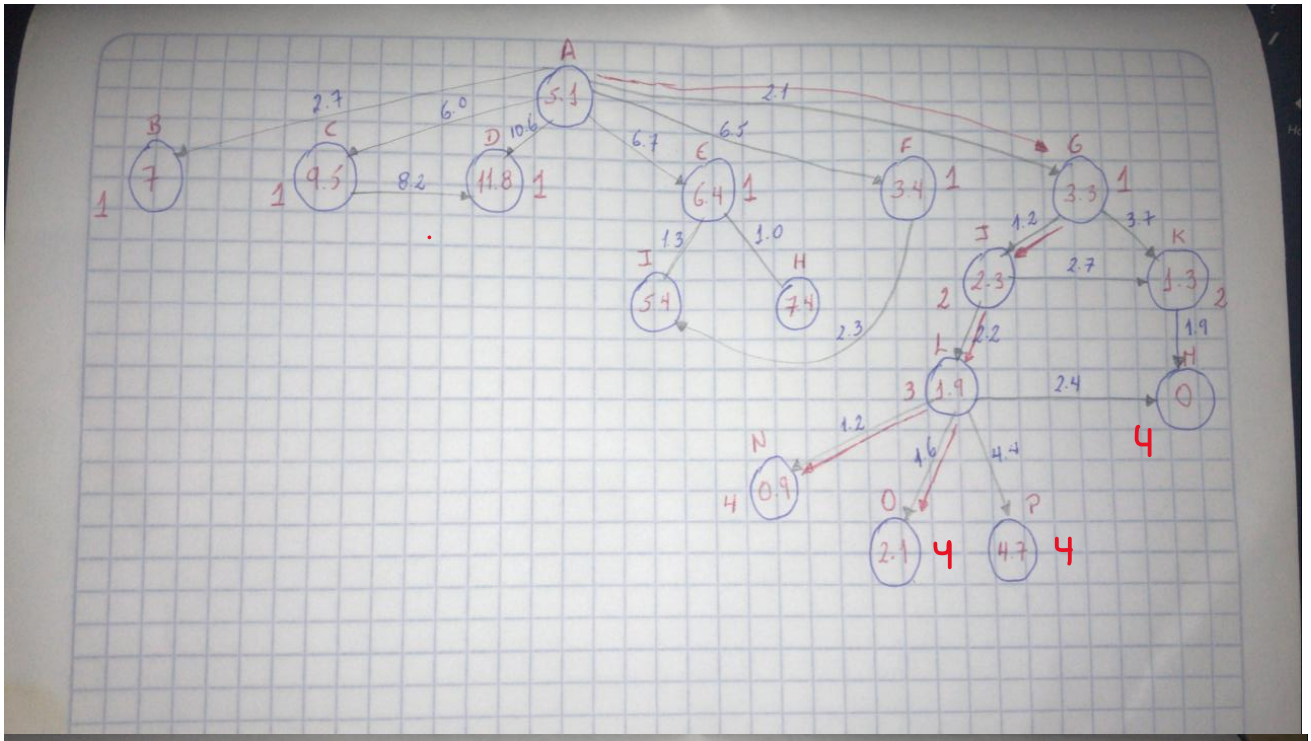
4


A
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D
11.8
E
6.4
F
3.4
G
3.3
H
7.4
I
5.4
J
2.3
K
1.3
L
1.9
M
0
N
0.9
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2.1
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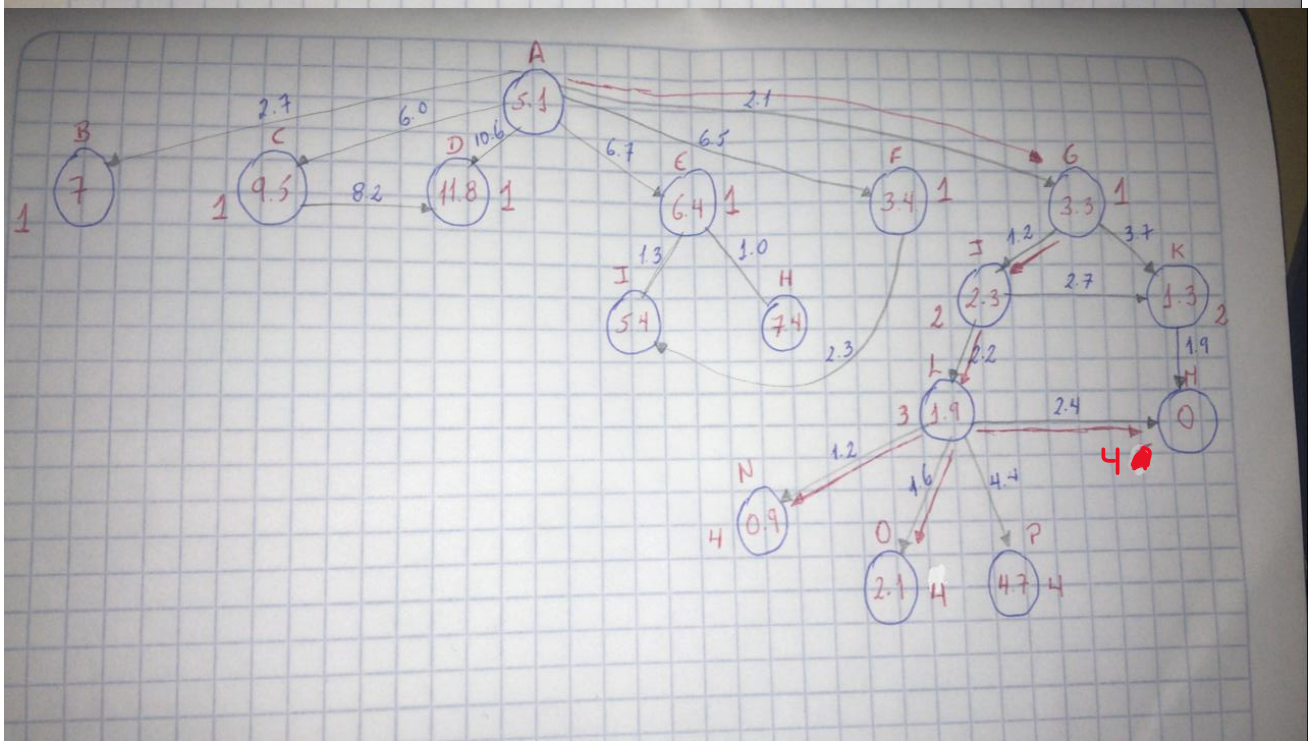
4.7
2.7
6.0
10.6
8.2
6.7
6.5
2.1
1.3
1.0
1.2
3.7
2.7
1.9
2.2
2.4
2.3
1.2
1.6
4.4
4


A
5.1
B
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C
9.5
D
11.8
E
6.4
F
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G
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I
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P
4.7
2.7
6.0
10.6
8.2
6.7
6.5
2.1
1.3
1.0
1.2
3.7
2.7
1.9
2.2
2.4
2.3
1.2
1.6
4.4
4

Visitados = {A}

{A, G}

{A, G, I}

{A, G, I, L}

{A, G, I, L, N}

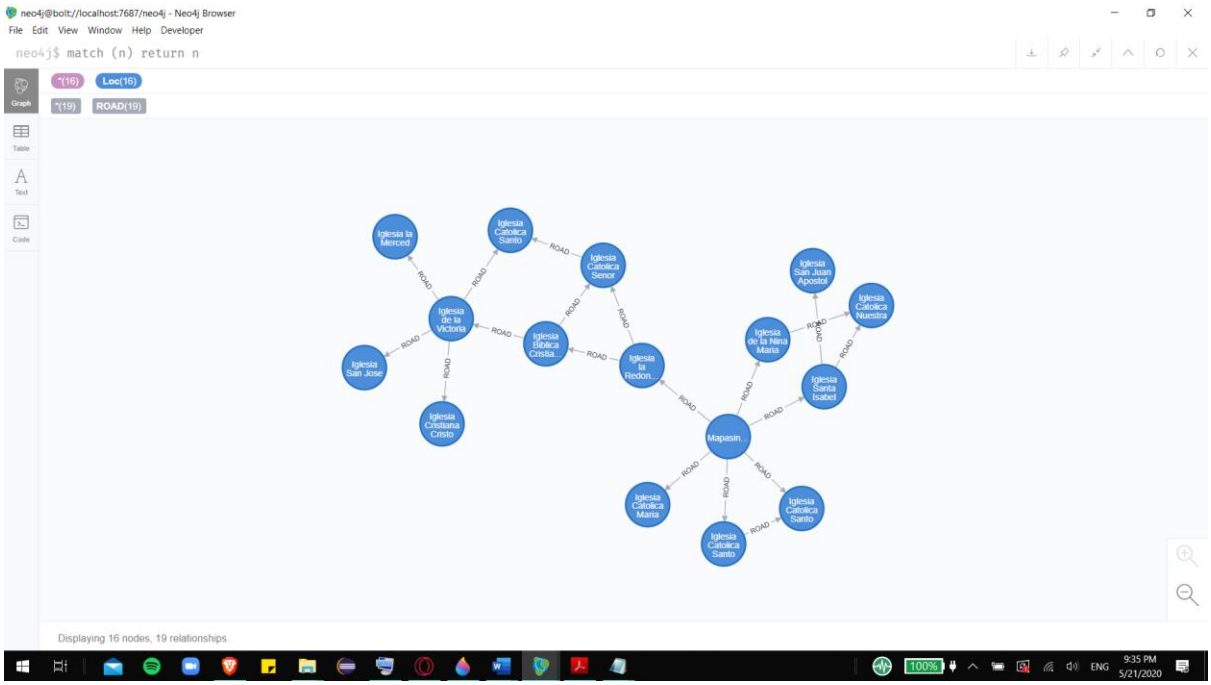
{A, G, I, L, N, O}

{A, G, I, L, N, O, M}

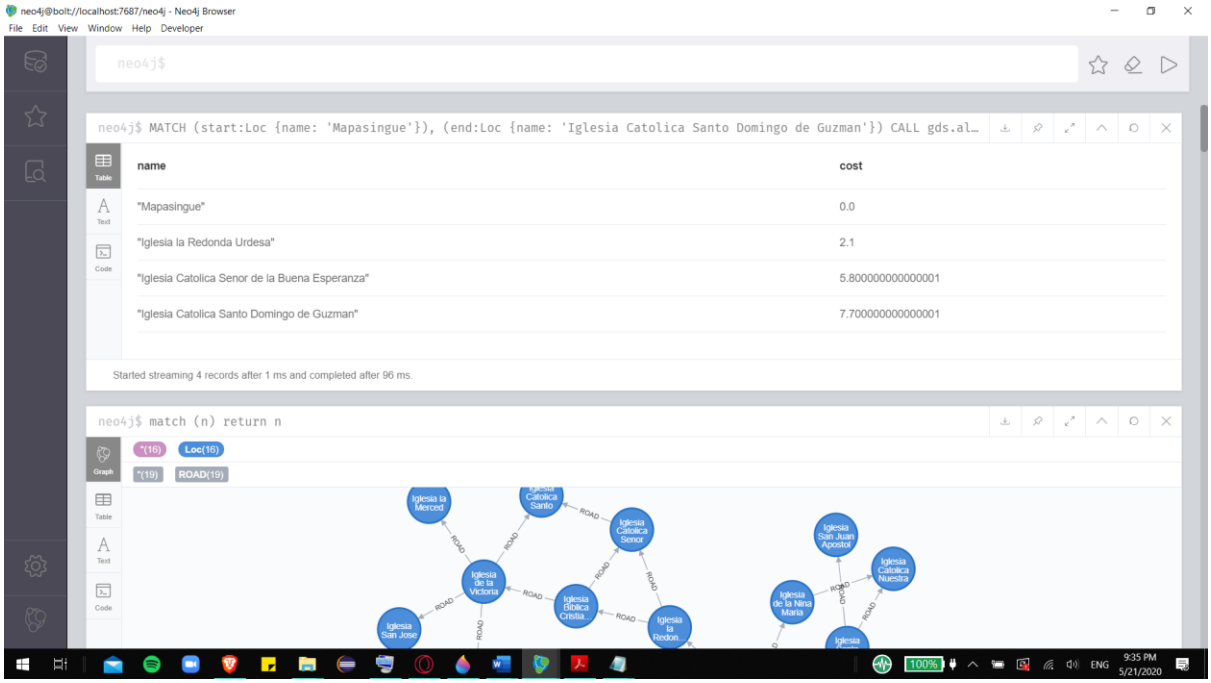
Ruta = {A, G, I, L, M}

- Programar y presentar los resultados mediante los algoritmos de busqueda en Neo4j (CostoMenor).

```
CREATE (a:Loc {name: 'Mapasingue'}),
(b:Loc {name: 'Iglesia Catolica Maria Madre de la Iglesia'}),
(c:Loc {name: 'Iglesia Catolica Santo Tomas de Aquino'}),
(d:Loc {name: 'Iglesia Catolica Santo Tomas'}),
(e:Loc {name: 'Iglesia Santa Isabel'}),
(f:Loc {name: 'Iglesia de la Nina Maria'}),
(g:Loc {name: 'Iglesia la Redonda Urdesa'}),
(h:Loc {name: 'Iglesia San Juan Apostol'}),
(i:Loc {name: 'Iglesia Catolica Nuestra Senora de Czestochowa'}),
(j:Loc {name: 'Iglesia Biblica Cristiana'}),
(k:Loc {name: 'Iglesia Catolica Senor de la Buena Esperanza'}),
(l:Loc {name: 'Iglesia de la Victoria Nuestra'}),
(m:Loc {name: 'Iglesia Catolica Santo Domingo de Guzman'}),
(n:Loc {name: 'Iglesia la Merced'}),
(o:Loc {name: 'Iglesia San Jose'}),
(p:Loc {name: 'Iglesia Cristiana Cristo Vive'}),
(a)-[:ROAD {cost: 2.7}]->(b),
(a)-[:ROAD {cost: 6.0}]->(c),
(a)-[:ROAD {cost: 10.6}]->(d),
(a)-[:ROAD {cost: 6.7}]->(e),
(a)-[:ROAD {cost: 6.5}]->(f),
(a)-[:ROAD {cost: 2.1}]->(g),
(c)-[:ROAD {cost: 8.2}]->(d),
(e)-[:ROAD {cost: 1.0}]->(h),
(e)-[:ROAD {cost: 1.3}]->(i),
(f)-[:ROAD {cost: 2.3}]->(i),
(g)-[:ROAD {cost: 1.2}]->(j),
(g)-[:ROAD {cost: 3.7}]->(k),
(j)-[:ROAD {cost: 2.7}]->(k),
(j)-[:ROAD {cost: 2.2}]->(l),
(k)-[:ROAD {cost: 1.9}]->(m),
(l)-[:ROAD {cost: 1.2}]->(n),
(l)-[:ROAD {cost: 1.6}]->(o),
(l)-[:ROAD {cost: 4.4}]->(p),
(l)-[:ROAD {cost: 2.4}]->(m);
```




```
MATCH (start:Loc {name: 'Mapasingue'}), (end:Loc {name: 'Iglesia Catolica Santo Domingo de Guzman'})
CALL gds.alpha.shortestPath.stream({
nodeQuery:'MATCH(n:Loc) RETURN id(n) AS id',
relationshipQuery:'MATCH(n:Loc)-[r:ROAD]->(m:Loc) RETURN id(n) AS source, id(m) AS target,
r.cost AS weight',
startNode: start,
relationshipWeightProperty: 'weight',
endNode: end
})
YIELD nodeId, cost
RETURN gds.util.asNode(nodeId).name AS name, cost
```


neo4j@bolt://localhost:7687/neo4j - Neo4j Browser
File Edit View Window Help Developer
neo4j$
neo4j$ MATCH (start:Loc {name: 'Mapasingue'}), (end:Loc {name: 'Iglesia Catolica Santo Domingo de Guzman'}) CALL gds.al…
Table
Text
Code
name
cost
"Mapasingue"
0.0
"Iglesia la Redonda Urdesa"
2.1
"Iglesia Catolica Senor de la Buena Esperanza"
5.800000000000001
"Iglesia Catolica Santo Domingo de Guzman"
7.700000000000001
Started streaming 4 records after 1 ms and completed after 96 ms.
neo4j$ match (n) return n
Graph
*(16)
Loc(16)
*(19)
ROAD(19)
Iglesia la Merced
Iglesia Catolica Santo
Iglesia Catolica Senor
Iglesia de la Victoria
Iglesia Catolica Nuestra
Iglesia San Juan Apostol
Iglesia de la Nina Maria
Iglesia San Jose
Iglesia Bolica Cristia
Iglesia la Redon
ROAD
100%
ENG
9:35 PM
5/21/2020