

Military Institute of Science and Technology
B.Sc in Computer Science and Engineering
Level-2, Term-II Assignment-2 : September 2020

Subject: CSE 215 (Data Structure and Algorithms II)

Full Marks: 20

INSTRUCTIONS:

1. Answer only **1 set** of problems
 2. Last digit of your ID is the set number that you need to answer. For example: Nawreen Anan Khandaker(201914006) will solve the problems of Set 6
 3. You must submit a single pdf of the photos of your **handwritten** solution script in the post for this assignment in Google Classroom
 4. The pdf must be named with your ID
 5. Problem - 1 contains **14** marks and Problem - 2 contains **6** marks for each set
 6. Google Classroom code: **y5nport**
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Set - 0

1. A company established a Local Area Network for their office consisting of **n** number of routers where each router is connected with rest other routers in the network and the routers are numbered by an integer from **1** to **n**. A router is connected with its neighbor router by a single Ethernet cable and data can be transmitted in both ways by the cable. In order to set up this network, the company needed a total **10** Ethernet cables. The cable setup cost between Router **i** and Router **j** is calculated by a function: **w(i,j)** where **w(i,j)** is determined by **i+j**. For example: cable setup cost between Router **1** and Router **2** is **w(1,2) = 1+2 = 3**. Suddenly, the company discovered that they can minimize the cable setup cost if they keep their network minimally connected in an optimal way. In that case they may have to allow lower data transmission rate but now they are only concerned about reducing the cable setup cost. You have been recruited to propose a network model for them as per their requirement so that their cable setup cost is as minimum as possible and the network remains connected. You need to show all necessary steps for constructing your model.
2. Write down the pseudocode for Dijkstra's Algorithm for finding the Single Source Shortest Path from a given graph **G(V,E)**. Analyze the running time complexity of the algorithm in term of **n** considering **G** as a Cycle Graph where **|V| = n**.

Set - 1

1. A company established a Local Area Network for their office consisting of **n** number of routers where each router is connected with rest other routers in the network and the routers are numbered by an integer from **1** to **n**. A router is connected with its neighbor router by a single Ethernet cable and data can be transmitted in both ways by the cable. In order to set up this network, the company needed a total **10** Ethernet cables. The cable setup cost between Router **i** and Router **j** is calculated by a function: **w(i,j)** where **w(i,j)** is determined by **|i²-j²|**. For example:

cable setup cost between Router 1 and Router 2 is $w(1,2) = |1^2 - 2^2| = 3$. Suddenly, the company discovered that they can minimize the cable setup cost if they keep their network minimally connected in an optimal way. In that case they may have to allow lower data transmission rate but now they are only concerned about reducing the cable setup cost. You have been recruited to propose a network model for them as per their requirement so that their cable setup cost is as minimum as possible and the network remains connected. You need to show all necessary steps for constructing your model.

2. Write down the pseudocode for Dijkstra's Algorithm for finding the Single Source Shortest Path from a given graph $G(V,E)$. Analyze the running time complexity of the algorithm in term of n considering G as a Complete Graph where $|V| = n$.

Set - 2

1. A company established a Local Area Network for their office consisting of n number of routers where each router is connected with rest other routers in the network and the routers are numbered by an integer from 1 to n . A router is connected with its neighbor router by a single Ethernet cable and data can be transmitted in both ways by the cable. In order to set up this network, the company needed a total 10 Ethernet cables. The cable setup cost between Router i and Router j is calculated by a function: $w(i,j)$ where $w(i,j)$ is determined by $i^2 + j^2$. For example: cable setup cost between Router 1 and Router 2 is $w(1,2) = 1^2 + 2^2 = 5$. Suddenly, the company discovered that they can minimize the cable setup cost if they keep their network minimally connected in an optimal way. In that case they may have to allow lower data transmission rate but now they are only concerned about reducing the cable setup cost. You have been recruited to propose a network model for them as per their requirement so that their cable setup cost is as minimum as possible and the network remains connected. You need to show all necessary steps for constructing your model.
2. Write down the pseudocode for Dijkstra's Algorithm for finding the Single Source Shortest Path from a given graph $G(V,E)$. Analyze the running time complexity of the algorithm in term of n considering G as a Wheel Graph where $|V| = n$.

Set - 3

1. A company established a Local Area Network for their office consisting of n number of routers where each router is connected with rest other routers in the network and the routers are numbered by an integer from 1 to n . A router is connected with its neighbor router by a single Ethernet cable and data can be transmitted in both ways by the cable. In order to set up this network, the company needed a total 10 Ethernet cables. The cable setup cost between Router i and Router j is calculated by a function: $w(i,j)$ where $w(i,j)$ is determined by $2(i+j)$. For example: cable setup cost between Router 1 and Router 2 is $w(1,2) = 2(1+2) = 6$. Suddenly, the company discovered that they can minimize the cable setup cost if they keep their network minimally connected in an optimal way. In that case they may have to allow lower data transmission rate but now they are only concerned about reducing the cable setup cost. You have been recruited to propose a network model for them as per their requirement so that their cable setup cost is as minimum as possible and the network remains connected. You need to show all necessary steps for constructing your model.

- Write down the pseudocode for Dijkstra's Algorithm for finding the Single Source Shortest Path from a given graph $G(V,E)$. Analyze the running time complexity of the algorithm in term of n considering G as a 2-Regular Graph where $|V| = n$.

Set - 4

- A company established a Local Area Network for their office consisting of n number of routers where each router is connected with rest other routers in the network and the routers are numbered by an integer from 1 to n . A router is connected with its neighbor router by a single Ethernet cable and data can be transmitted in both ways by the cable. In order to set up this network, the company needed a total 10 Ethernet cables. The cable setup cost between Router i and Router j is calculated by a function: $w(i,j)$ where $w(i,j)$ is determined by $|i^2-j^2|/2$. For example: cable setup cost between Router 1 and Router 2 is $w(1,2) = |1^2-2^2|/2 = 1.5$. Suddenly, the company discovered that they can minimize the cable setup cost if they keep their network minimally connected in an optimal way. In that case they may have to allow lower data transmission rate but now they are only concerned about reducing the cable setup cost. You have been recruited to propose a network model for them as per their requirement so that their cable setup cost is as minimum as possible and the network remains connected. You need to show all necessary steps for constructing your model.
- Write down the pseudocode for Dijkstra's Algorithm for finding the Single Source Shortest Path from a given graph $G(V,E)$. Analyze the running time complexity of the algorithm in terms of n and k considering G as a k -Regular Graph where $|V| = n$.

Set - 5

- A company established a Local Area Network for their office consisting of n number of routers where each router is connected with rest other routers in the network and the routers are numbered by an integer from 1 to n . A router is connected with its neighbor router by a single Ethernet cable and data can be transmitted in both ways by the cable. In order to set up this network, the company needed a total 10 Ethernet cables. The cable setup cost between Router i and Router j is calculated by a function: $w(i,j)$ where $w(i,j)$ is determined by $(i^2+j^2)/2$. For example: cable setup cost between Router 1 and Router 2 is $w(1,2) = (1^2+2^2)/2 = 2.5$. Suddenly, the company discovered that they can minimize the cable setup cost if they keep their network minimally connected in an optimal way. In that case they may have to allow lower data transmission rate but now they are only concerned about reducing the cable setup cost. You have been recruited to propose a network model for them as per their requirement so that their cable setup cost is as minimum as possible and the network remains connected. You need to show all necessary steps for constructing your model.
- Write down the pseudocode for Bellman Ford's Algorithm for finding the Single Source Shortest Path from a given graph $G(V,E)$. Analyze the running time complexity of the algorithm in term of n considering G as a Cycle Graph where $|V| = n$.

Set - 6

- A company established a Local Area Network for their office consisting of n number of routers where each router is connected with rest other routers in the network and the routers are numbered by an integer from 1 to n . A router is connected with its neighbor router by a single Ethernet cable and data can be transmitted in both ways by the cable. In order to set up this

network, the company needed a total **10** Ethernet cables. The cable setup cost between Router **i** and Router **j** is calculated by a function: **w(i,j)** where **w(i,j)** is determined by **i+j**. For example: cable setup cost between Router **1** and Router **2** is **w(1,2) = 1+2 = 3**. Suddenly, the company discovered that they can minimize the cable setup cost if they keep their network minimally connected in an optimal way. In that case they may have to allow lower data transmission rate but now they are only concerned about reducing the cable setup cost. You have been recruited to propose a network model for them as per their requirement so that their cable setup cost is as minimum as possible and the network remains connected. You need to show all necessary steps for constructing your model.

- Write down the pseudocode for Bellman Ford's Algorithm for finding the Single Source Shortest Path from a given graph **G(V,E)**. Analyze the running time complexity of the algorithm in term of **n** considering **G** as a Complete Graph where **|V| = n**.

Set - 7

- A company established a Local Area Network for their office consisting of **n** number of routers where each router is connected with rest other routers in the network and the routers are numbered by an integer from **1** to **n**. A router is connected with its neighbor router by a single Ethernet cable and data can be transmitted in both ways by the cable. In order to set up this network, the company needed a total **10** Ethernet cables. The cable setup cost between Router **i** and Router **j** is calculated by a function: **w(i,j)** where **w(i,j)** is determined by $|i^2-j^2|$. For example: cable setup cost between Router **1** and Router **2** is **w(1,2) = |1²-2²| = 3**. Suddenly, the company discovered that they can minimize the cable setup cost if they keep their network minimally connected in an optimal way. In that case they may have to allow lower data transmission rate but now they are only concerned about reducing the cable setup cost. You have been recruited to propose a network model for them as per their requirement so that their cable setup cost is as minimum as possible and the network remains connected. You need to show all necessary steps for constructing your model.
- Write down the pseudocode for Bellman Ford's Algorithm for finding the Single Source Shortest Path from a given graph **G(V,E)**. Analyze the running time complexity of the algorithm in term of **n** considering **G** as a Wheel Graph where **|V| = n**.

Set - 8

- A company established a Local Area Network for their office consisting of **n** number of routers where each router is connected with rest other routers in the network and the routers are numbered by an integer from **1** to **n**. A router is connected with its neighbor router by a single Ethernet cable and data can be transmitted in both ways by the cable. In order to set up this network, the company needed a total **10** Ethernet cables. The cable setup cost between Router **i** and Router **j** is calculated by a function: **w(i,j)** where **w(i,j)** is determined by i^2+j^2 . For example: cable setup cost between Router **1** and Router **2** is **w(1,2) = 1²+2² = 5**. Suddenly, the company discovered that they can minimize the cable setup cost if they keep their network minimally connected in an optimal way. In that case they may have to allow lower data transmission rate but now they are only concerned about reducing the cable setup cost. You have been recruited to propose a network model for them as per their requirement so that their cable setup cost is as minimum as possible and the network remains connected. You need to show all necessary steps for constructing your model.

2. Write down the pseudocode for Bellman Ford's Algorithm for finding the Single Source Shortest Path from a given graph $G(V,E)$. Analyze the running time complexity of the algorithm in term of n considering G as a 2-Regular Graph where $|V| = n$.

Set - 9

1. A company established a Local Area Network for their office consisting of n number of routers where each router is connected with rest other routers in the network and the routers are numbered by an integer from 1 to n . A router is connected with its neighbor router by a single Ethernet cable and data can be transmitted in both ways by the cable. In order to set up this network, the company needed a total 10 Ethernet cables. The cable setup cost between Router i and Router j is calculated by a function: $w(i,j)$ where $w(i,j)$ is determined by $2(i+j)$. For example: cable setup cost between Router 1 and Router 2 is $w(1,2) = 2(1+2) = 6$. Suddenly, the company discovered that they can minimize the cable setup cost if they keep their network minimally connected in an optimal way. In that case they may have to allow lower data transmission rate but now they are only concerned about reducing the cable setup cost. You have been recruited to propose a network model for them as per their requirement so that their cable setup cost is as minimum as possible and the network remains connected. You need to show all necessary steps for constructing your model.
2. Write down the pseudocode for Bellman Ford's Algorithm for finding the Single Source Shortest Path from a given graph $G(V,E)$. Analyze the running time complexity of the algorithm in term of n and k considering G as a k -Regular Graph where $|V| = n$.