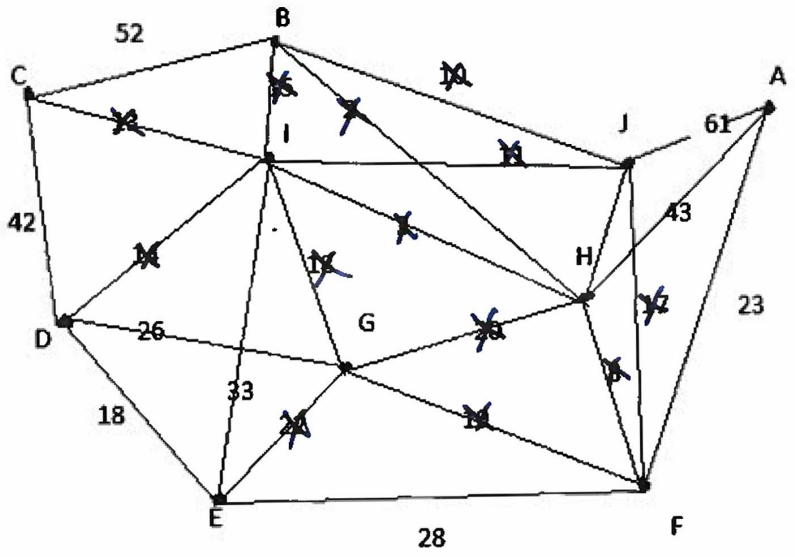
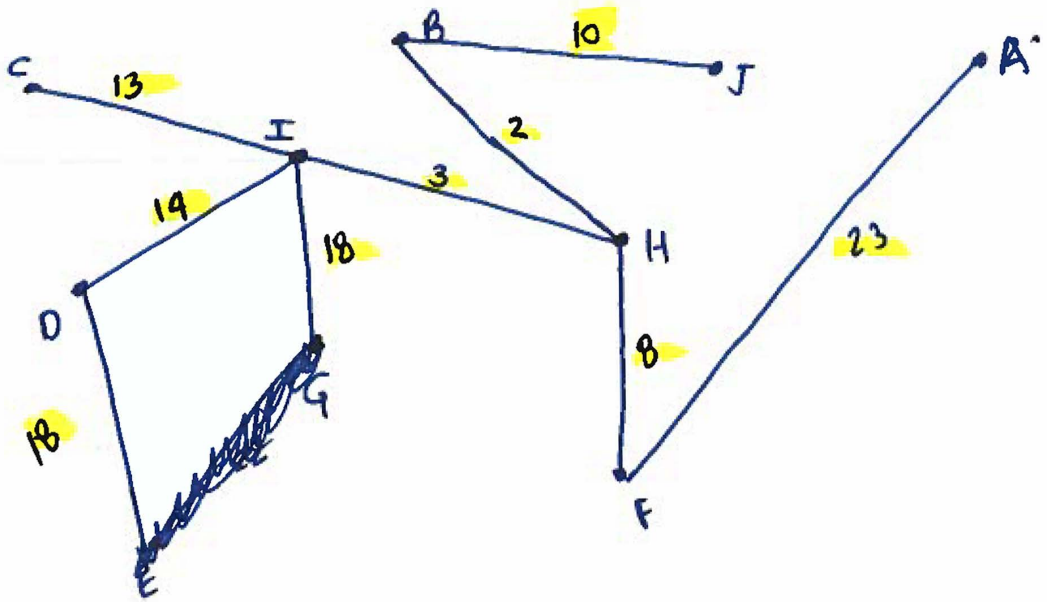
Math 142
Graph Theory Review for Test 3
Spring 2023

Part I: Given the graph below, use Kruskal's Algorithm to find the minimum spanning tree to connect each home (node) with fiber optic cable to provide instant access movies. Given each value represents thousands of dollars in cost (material and labor) to connect a cable to each of the homes what is the total cost (in thousands of dollars) to a company to connect each home to the movie network?



Draw your network here and provide the total cost.



Part II: You are a technician whose responsibilities are to service computer networks for a firm in Florida. The firm has offices in the cities listed below. ***You live in Orlando.*** Given the distances from Orlando to each office you are to visit monthly, answer the following questions about your Hamilton Circuit possibilities.

City	Fort Meyers	Jacksonville	Key West	Orlando	Pensacola	Tallahassee	Tampa
Fort Meyers	---	312	279	171	589	397	130
Jacksonville	312	---	507	141	355	164	198
Key West	279	507	---	387	821	627	402
Orlando	171	141	387	---	451	257	84
Pensacola	589	355	821	451	---	193	459
Tallahassee	397	164	627	257	193	---	273
Tampa	130	198	402	84	459	273	---

How many possible routes exist (Hamilton circuits) for you to choose from? $(n-1)! = (7-1)! = 6!$
$= 720$

How many unique routes exist (Hamilton circuits) for you to choose from? $\frac{(n-1)!}{2} = \frac{720}{2} = 360$

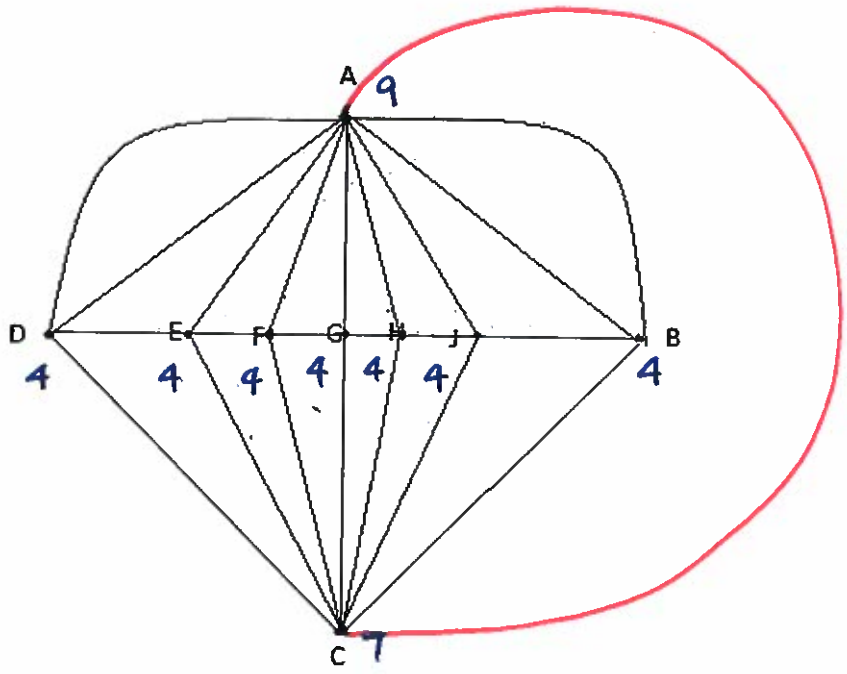
Using the nearest neighbor algorithm, what would be an efficient route so you can visit each office in each Florida city, and how many miles would you travel to visit each city?

Name your route here:

ORL $\underline{84}$ TAM $\underline{130}$ FT. MY $\underline{279}$ KEY W $\underline{507}$ JACK $\underline{164}$ TALL $\underline{193}$ PEN $\underline{451}$ ORL

List your total mileage here:

Part III: For graph given, answer the following questions below.



How many nodes exist? 9

How many edges exist? 22

What is the sum of the degrees of the nodes? 44

Does the graph have an Euler Circuit? Why or why not? NO!

Does the graph have an Euler Path? Why or why not? YES!

If the graph does not have an Euler Circuit, what edges could you add to the graph so an Euler Circuit would exist?

Math 142
Section 5.2: Permutation and Combinations Review for Test 3
Spring 2021

1. A company has to transfer 4 of its 10 junior executives to another city. In how many ways can the four be chosen?

$$_nC_r = \frac{n!}{r!(n-r)!} = {}_{10}C_4 = \frac{10!}{4!(10-4)!} = \frac{10!}{4!\,6!} = \frac{10\cdot 9\cdot 8\cdot 7}{4\cdot 3\cdot 2\cdot 1} = 210$$

2. A child has a penny, a nickel, a dime, a quarter, and a half-dollar. She may spend any of three coins. In how many different ways can the child choose to do this? What is the most money that the child can spend with the three coins?

$$_5C_3 = \frac{5!}{3!(5-3)!} = \frac{5!}{3!(2)!} = \frac{5\cdot 4}{2\cdot 1} = \frac{20}{2} = 10 \text{ WAYS}$$

MAX TOTAL: 85¢

3. Working with a group of 12 basketball players, a coach selects a guard then a center. How many different ways can a coach choose?

$$_{12}C_2 = \frac{12!}{2!(12-2)!} = \frac{12!}{2!\,10!} = \frac{12\cdot 11}{2\cdot 1} = 66 \text{ WAYS}$$

4. A Virginia license plate is made up of 3 letters, followed by 4 digits. If the license plate cannot begin with an R nor end with a zero, how many license plates can be made, provided repetition is allowed?

$$\underset{\uparrow}{\_\_} \cdot \underset{\uparrow}{\_\_} \cdot \underset{\uparrow}{\_\_} \cdot \underset{\uparrow}{\_\_} \cdot \underset{\uparrow}{\_\_} \cdot \underset{\uparrow}{\_\_} \cdot \underset{\uparrow}{\_\_}$$

$$25 \cdot 26 \cdot 26 \cdot 10 \cdot 10 \cdot 10 \cdot 9 = 152{,}100{,}000$$

5. On a math test, you are given 10 questions. You must answer only 7. In how many ways can you choose to answer the seven questions?

$$_{10}C_7 = \frac{10!}{7!(10-7)!} = \frac{10!}{7!\,3!} = \frac{10\cdot 9\cdot 8}{3\cdot 2\cdot 1} = 120$$

6. At Radford University, each student has a 6 digit identification number. If the number must start with 7, how many student identification numbers exist (repetition of numbers is allowed).

$$\underset{\uparrow}{7} \quad \underset{\uparrow}{\_\_} \quad \underset{\uparrow}{\_\_} \quad \underset{\uparrow}{\_\_} \quad \underset{\uparrow}{\_\_} \quad \underset{\uparrow}{\_\_}$$
$$1 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 = 100{,}000$$

7. In a state lottery game, 6 numbers are chosen from a set of 43 numbers (1-43). In how many ways can the 6 numbers be chosen? $1 MILLION

$$_{43}C_6 = \frac{43!}{6!(43-6)!} = \frac{43!}{6!\,37!} = \frac{43\cdot 42\cdot 41\cdot 40\cdot 39\cdot 38}{6\cdot 5\cdot 4\cdot 3\cdot 2\cdot 1}$$
$$= 7{,}659{,}647$$