

Problems set 1

Exercise 1 :

- 1- Build a complete undirected graph of order 6.
- 2- Construct a complete directed graph of order 5.
- 3- We are interested in graphs in which all vertices have a degree of three. Build such graphs with 4 vertices, 5 vertices, 6 vertices, and 7 vertices.
- 4- Attempt to construct an undirected graph with at least two vertices in which all vertices have distinct degrees.

Exercise 2

The table below provides the internal connections operated by Air Algérie as of December 31, 2023.

	Algiers	Biskra	Annaba	Oran	Constantine	Adrar
Algiers		x			x	
Biskra	x		x			
Annaba	x					x
Oran	x				x	
Constantine	x			x		x
Adrar	x	x		x		

- 1- Represent the different connections with a graph.
- 2- Determine the destinations of flights departing from the city of Biskra.

Exercise 3

The following table represents the involvement of the five (05) referees in a tournament, with 6 matches scheduled for the first day.

Referee	A1	A2	A3	A4	A5
Match	M1, M2	M3,M4,M2	M5,M4,M6	M1,M3	M6,M5

Represent the scheduling of the matches for the first day using a graph.

Note : Two vertices are connected by an edge if the corresponding matches can take place at the same time.

Exercise 4

We define a relation R on the set of the first 9 positive natural numbers as follows:

$x R y \iff x$ is a divisor of y

- 1- Represent this relation with a directed graph.
- 2- Determine from the graph the set of even numbers and the set of prime numbers.

Exercise 5

Modelise the following problem with a graph:

We want to draw 4 liters of liquid from a barrel. For this, we have two containers (non-graduated!), one of 5 liters, and the other of 3 liters... How should we proceed?

Exercise 6

Three professors, P1, P2, and P3, will have to teach a certain number of hours to three classes, C1, C2, and C3, next Monday:

- P1 needs to teach 2 hours to C1 and 1 hour to C2.
- P2 needs to teach 1 hour to C1, 1 hour to C2, and 1 hour to C3.
- P3 needs to teach 1 hour to C1, 1 hour to C2, and 2 hours to C3.

How can you represent this situation with a graph? What type of graph do you obtain? How many time slots will be needed at a minimum? Use the graph to propose a schedule for these professors on Monday.

Exercise 7

A chess tournament involves 6 individuals. Each player must face all the others. Construct a graph representing all possible games. What type of graph do you obtain? If each player plays only one match per day, how many days will it take to finish the tournament? Use the graph to propose a match schedule.

Exercise 8

A goat, a cabbage, and a wolf are on one side of a river; a ferryman wants to transport them to the other side, but his boat is too small to carry more than one of them at a time. How should he proceed in order to never leave the wolf and the goat together unsupervised, as well as the goat and the cabbage?