The background features a large, semi-transparent watermark of the NPTEL logo. It consists of a circular emblem with a stylized flower or star in the center, surrounded by a ring of rectangular blocks. Below the emblem, the word "NPTEL" is written in large, bold, sans-serif capital letters.

NPTEL MOOC, JAN-FEB 2015
Week 1, Module 2

DESIGN AND ANALYSIS OF ALGORITHMS

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Example 1: Air travel

- * Barbet Airlines serves several cities in India
- * Some cities are connected by direct flights
- * Want to compute all pairs of cities A,B such that A and B are connected by a sequence of flights

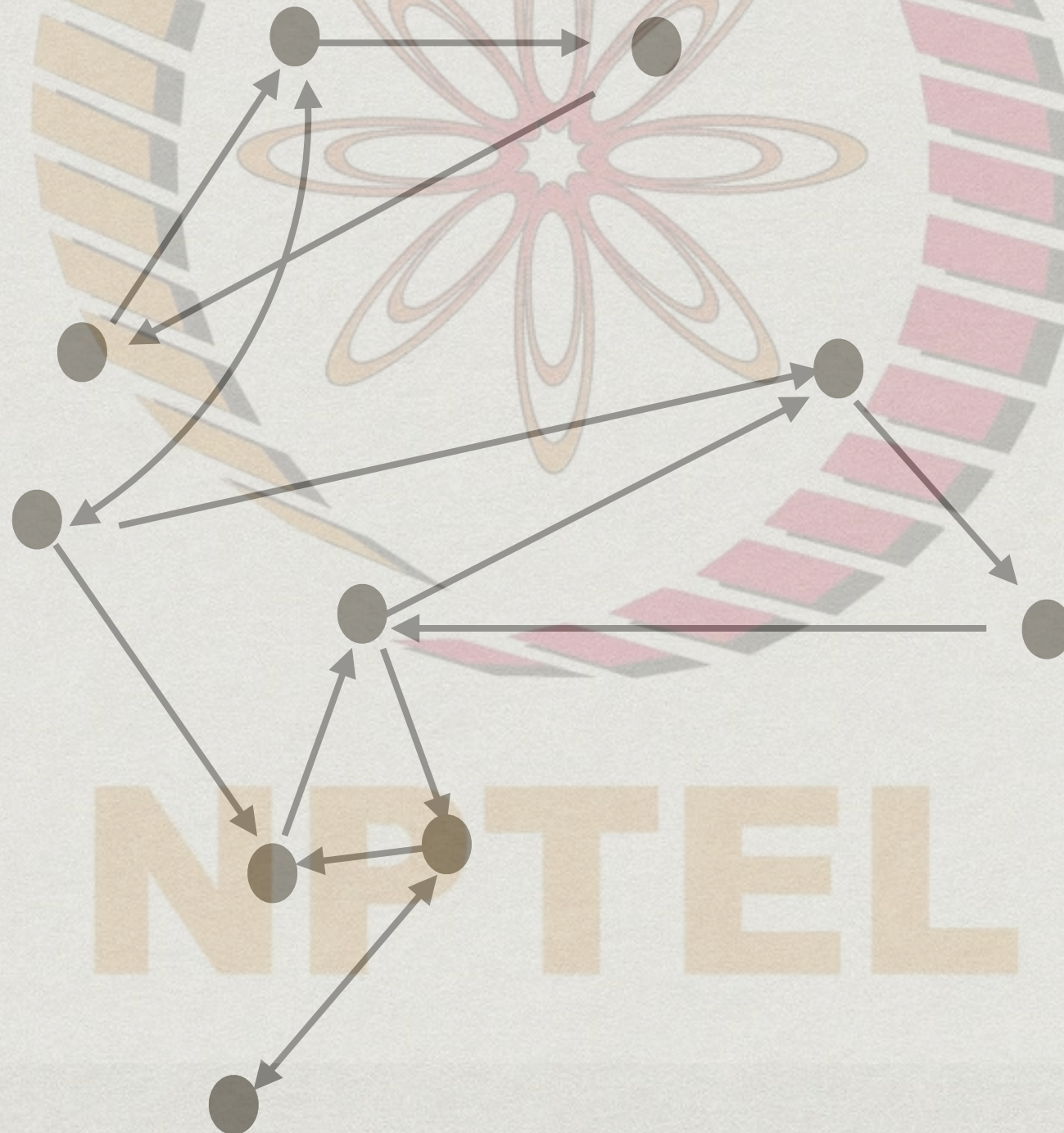
NPTTEL



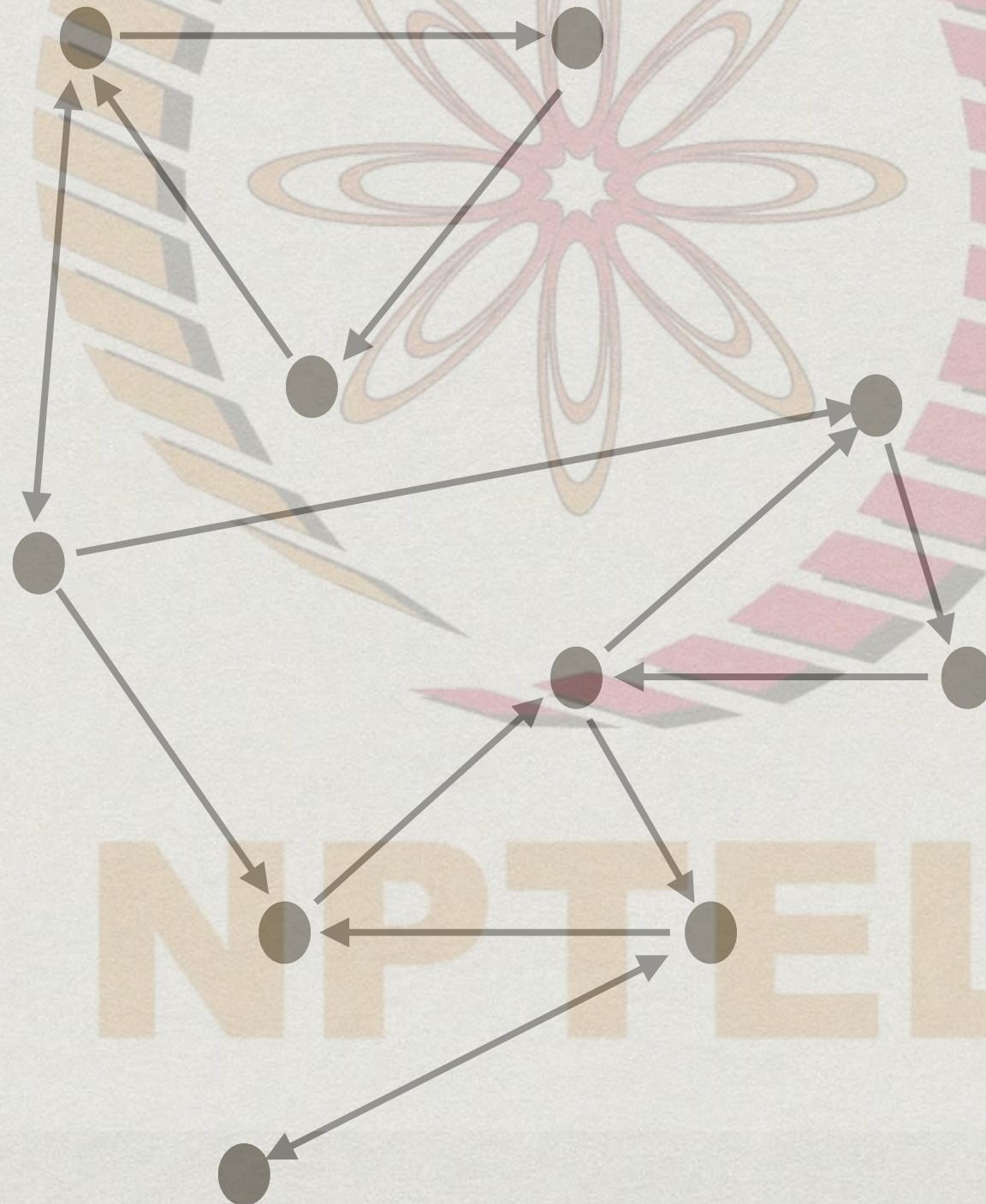
- * Throw away the map and record the network
- * This is a **graph**—a collection of nodes and edges



- * Can distort the picture without changing meaning



- * Can distort the picture without changing meaning



Connected destinations

- * Compute **paths** in the graph
- * How do we represent the graph so that we can manipulate it using a computer program?
 - * Suitable data structure
- * How do we design an efficient algorithm for this data representation?

Efficiency?

- * N cities, F direct flights
- * Computing paths depends on N and F
- * What is this dependency?
- * How large a value of N and F can we handle?
 - * Online booking requires response in seconds

Variations

- * Flights have arrival and departure times
- * Only some connections are feasible
 - * Should not have to wait overnight
 - * ... or more than 4 hours
- * How to compute **feasible paths** with constraints?

Other problems

- * Each sector has a cost
 - * Compute cheapest route between a pair of cities
- * Some aircraft grounded for maintenance
 - * Which routes to operate to maintain connectivity?