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

DESIGN AND ANALYSIS OF ALGORITHMS

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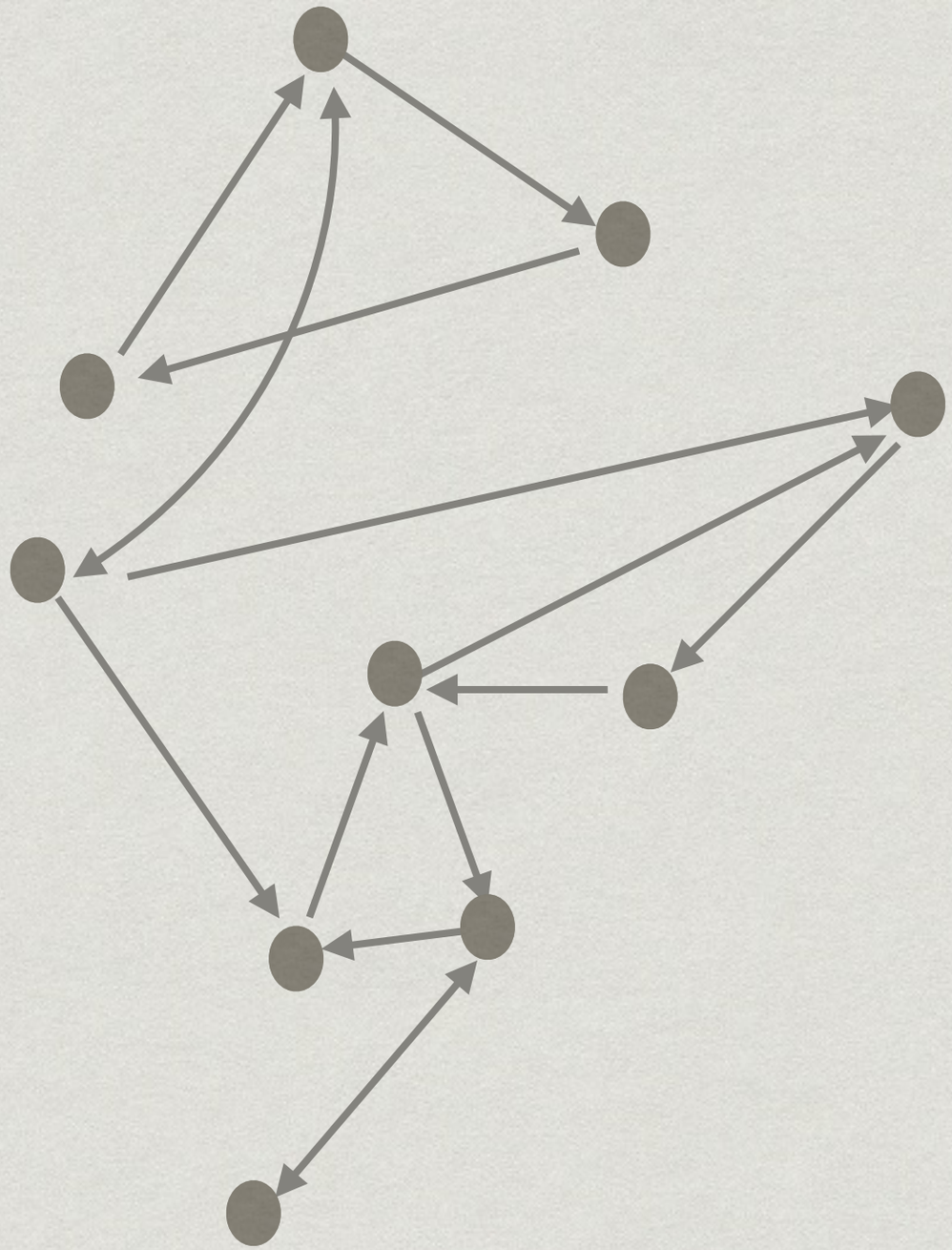
Example 1: Air travel

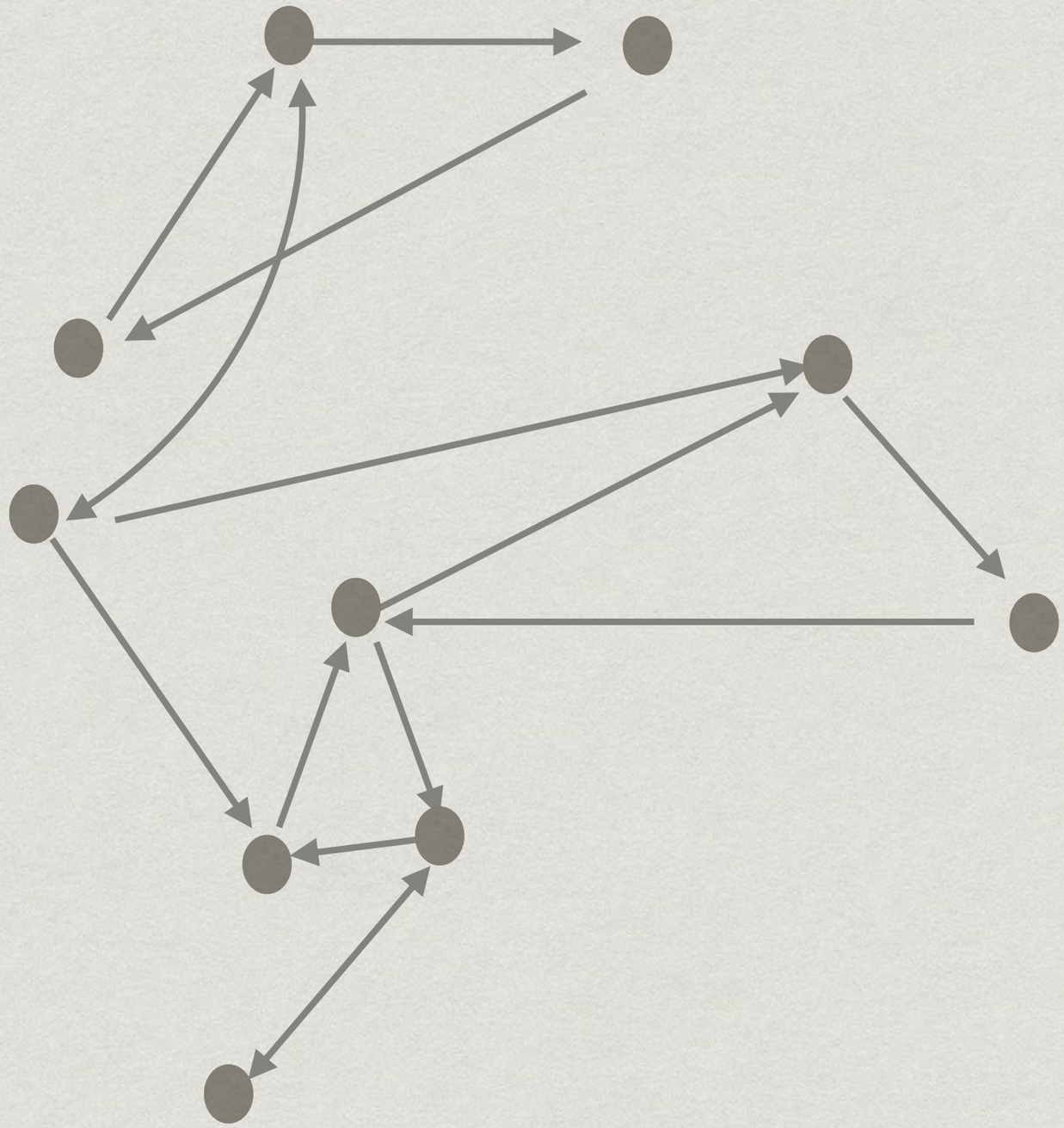
- Barbet Airlines serves several cities in India
- Some cities are connected by direct flights
- Want to compute all pairs of cities A,B such that A and B are connected by a sequence of flights

SRINAGAR
LEH
Delhi
NEW DELHI
GANGTOK
DARJEELING
JAISALMER
JAIPUR
AGRA
JODHPUR
RANTHAMBORE
GWALIOR
VARANASI
Varanasi
UDAIPUR
KHAJURAHO
Ahmedabad
AHMEDABAD
SASAN GIR
KOLKATA
Kolkata
MUMBAI
AURANGABAD
Mumbai
PUNE
Hyderabad
HYDERABAD
VISAKHAPATNAM
Visakhapatnam
HAMPI
GOA
Bangalore
BANGALORE
MANGALORE
MYSORE
Chennai
CHENNAI
MAHABALIPURAM
OOTY
TIRUVANNAMALAI
PONDICHERRY
CALICUT
TRICHY
MADURAI
COCHIN
PERIYAR
ALLEPPEY
TRIVANDRUM
Trivandrum

- 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



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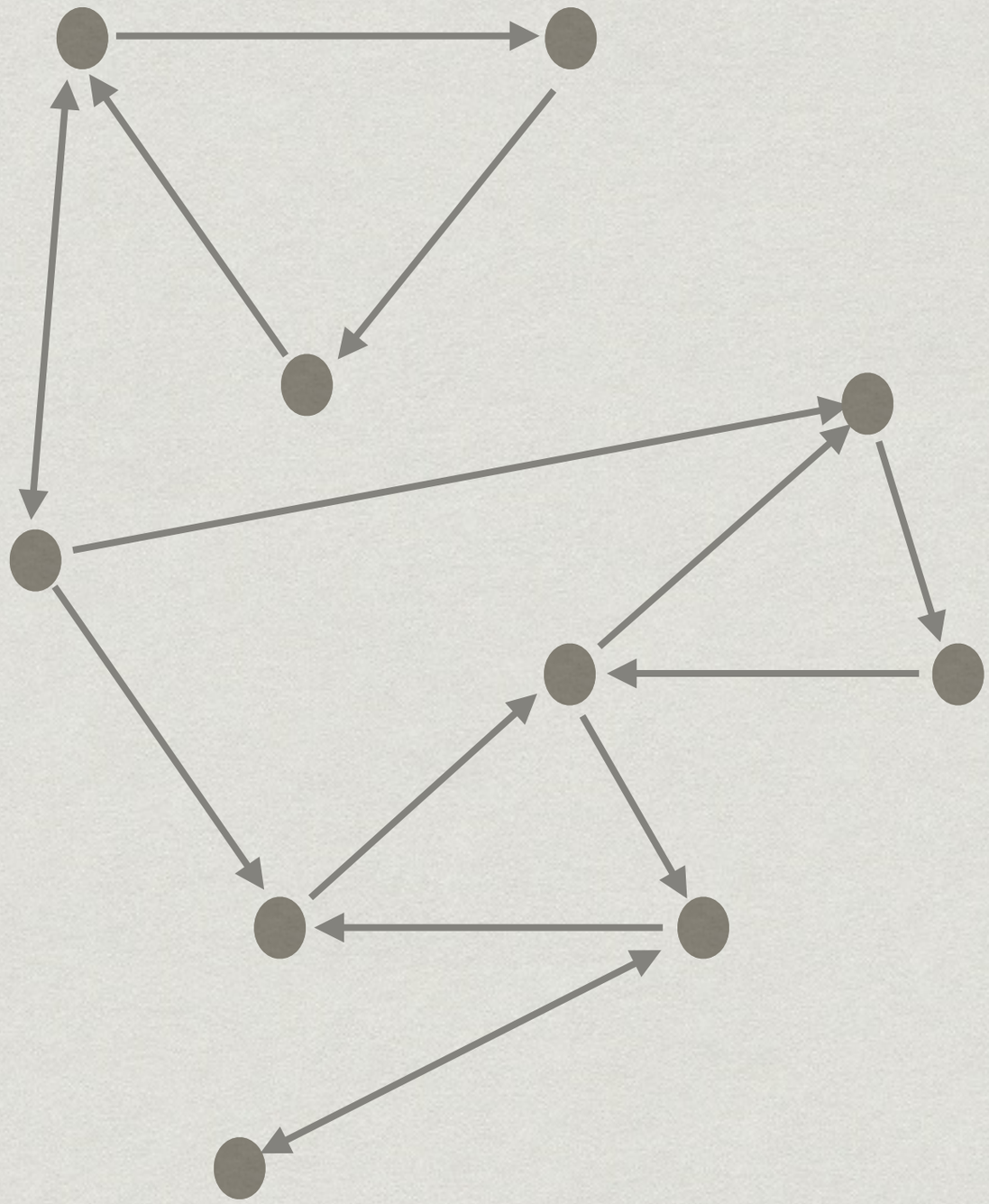

Connected destinations

- 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?