### Graphs

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<th>USD</th>
<th>GBP</th>
<th>CAD</th>
<th>EUR</th>
<th>AUD</th>
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Set (accessed by final currency)

exchange rates in August 2004

What data structure is best if you just want to look up an exchange rate?

What if you want to determine if an arbitrage scheme exists?
Graph Representing Exchange Rates

- **Vertex**
- **Edge (directed)**
- **Path**
- **Cycle**
- **Edge Weight**
Task Scheduling

Precedence Graph for Changing a Flat Tire

- Drive off
- Put lug tool away
- Tighten lugs
- Lower car
- Put lugs on

- Remove lugs
- Put on spare
- Remove spare from trunk
- Remove old tire
- Jack up car

- Get out lug tool
- Get out owner's manual
- Place jack under car
- Take out jack

a must precede b
Finding Shortest Travel Routes

- Each airport is a vertex
- Sample edges (flight)

* multigraph - multiple edges between vertices

* AM 171

#edges = #flights
and many more

- image segmentation
- minimizing infrastructure cost (e.g., laying optical fiber) to allow travel/communication between a set of locations
- executing a makefile

A lot of problems can be formulated as graph problems
Types of graphs

\textbf{unweighted}  \hspace{1cm} \textbf{name of edge}

\begin{itemize}
  \item \textbf{directed}
  \item \textbf{undirected}
\end{itemize}
Weighted directed multigraph