CMPT 280

Topic 19: Graphs

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References

- Textbook, Chapter 19

Graphs

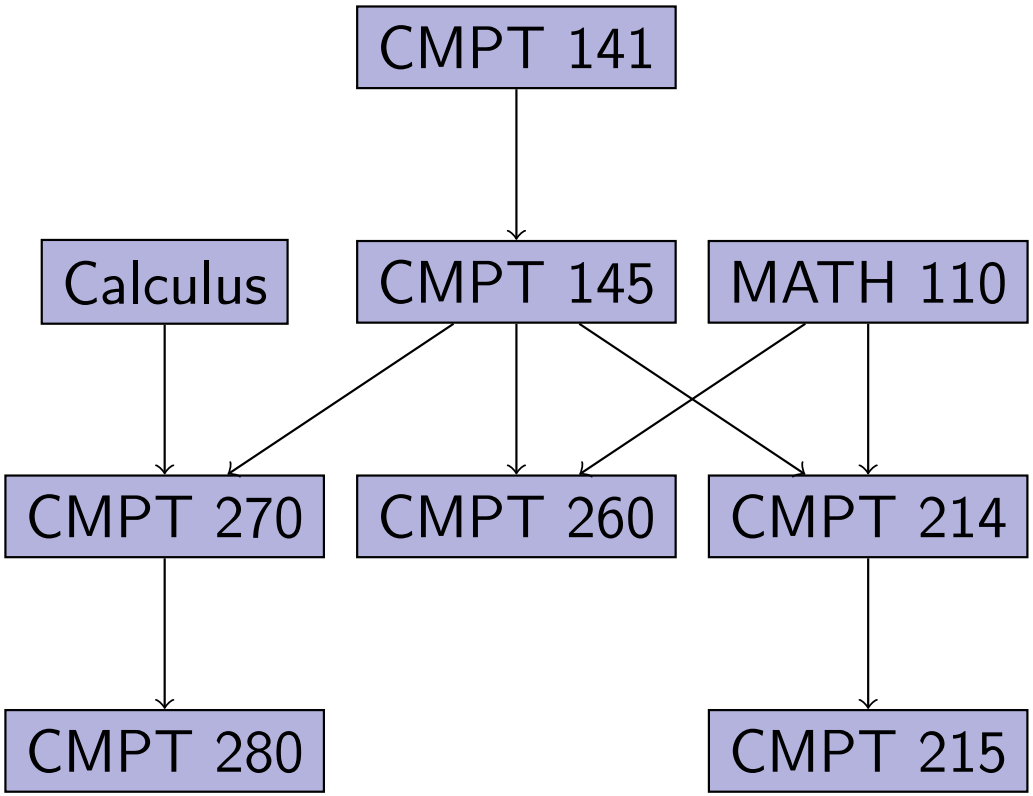
Definition

A *graph* $G = (V, E)$ consists of a set V of *vertices* (or *nodes*) and a set $E \subseteq V \times V$ of *edges* (or *arcs*).

A graph is a representation of a mathematical relation. The actual relation depends on what the vertices represent.

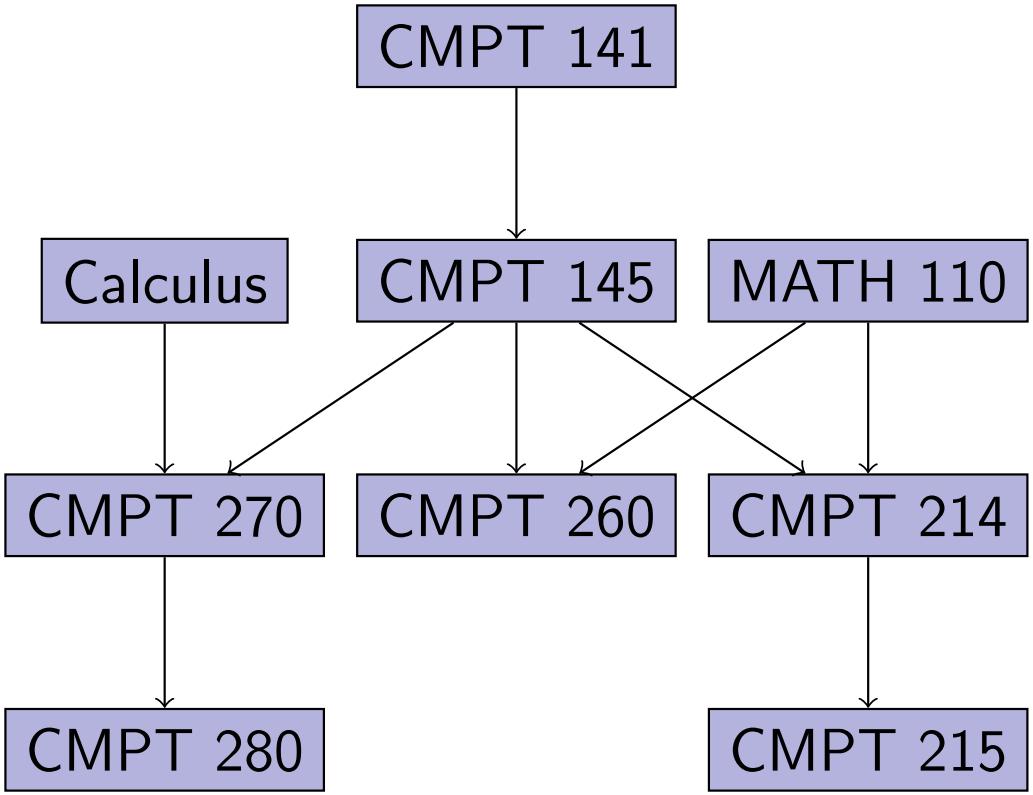
Graphs as Relations

If graph vertices represent courses, then $E \subseteq V \times V$ could be the relation "is a prerequisite for".



In what ways is this **not** a tree?

Exercise 1



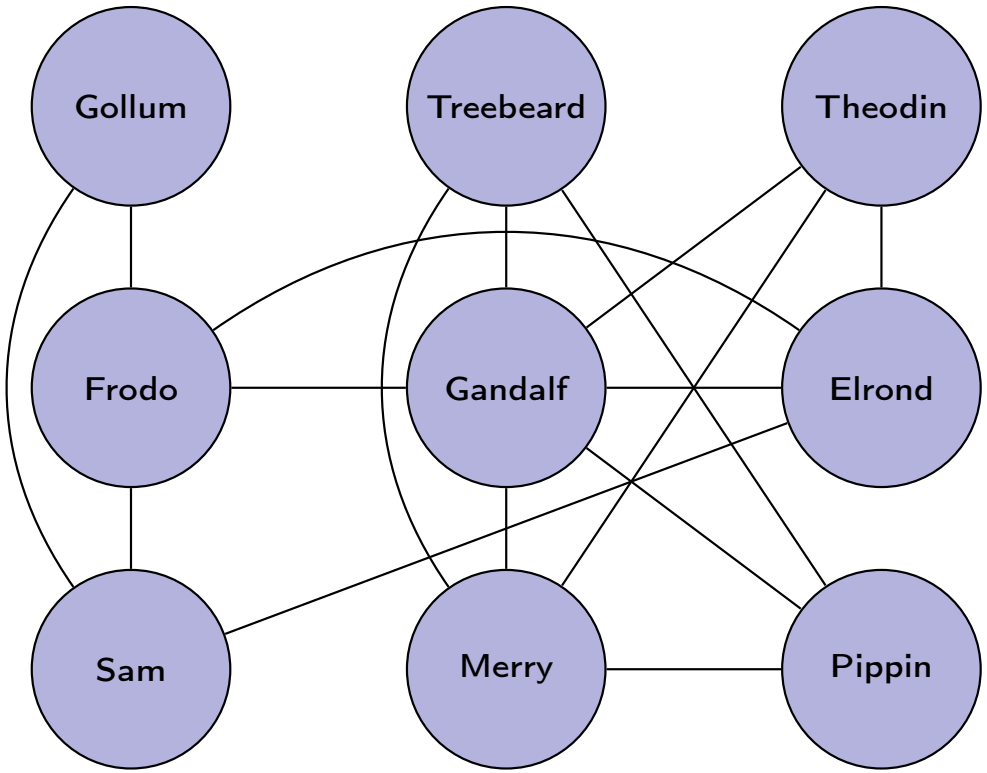
a) What are the sets V and E for this graph?

b) What is the indegree of CMPT 214? CMPT 280?

c) What is the outdegree of CMPT 145? CMPT Math 110?

Exercise 2

Subgraph of Social Graph of "Return of the King"



Source: http://visualizing.org/full-screen/112639 (link now dead)

a) What is the degree of "Gandalf"? "Gollum"?

Exercise 2 (continued)

b) Give examples of a walk from "Treebeard" to "Gollum".

c) Give examples of a trail from "Theodin" to "Sam".

d) Give examples of a path from "Merry" to "Frodo".

e) What is the shortest path from "Gollum" to "Pippin"?

f) Give an example of a *Hamiltonian Path* in this graph.
A Hamiltonian Path is a path that visits every vertex.

g) Give an example of a circuit that starts and ends at Gandalf.

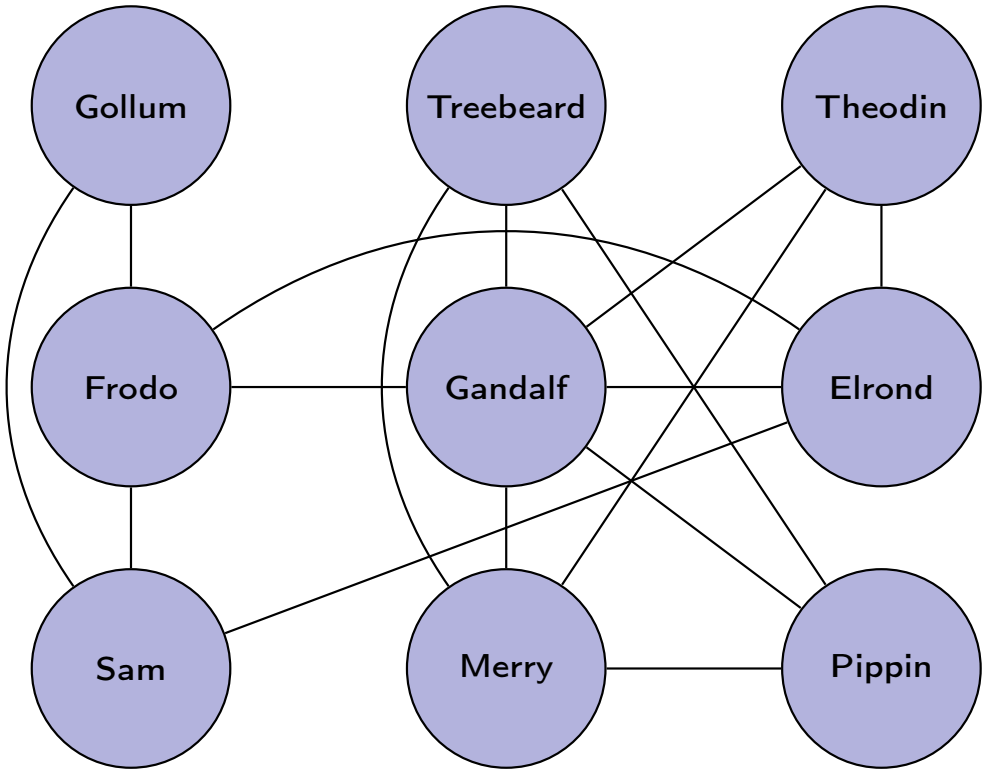
h) Give an example of a cycle that starts and ends at Gandalf.

i) How many connected components does this graph have?

j) If we removed "Frodo" and "Eldrond", how many connected components would the graph have?

Exercise 3

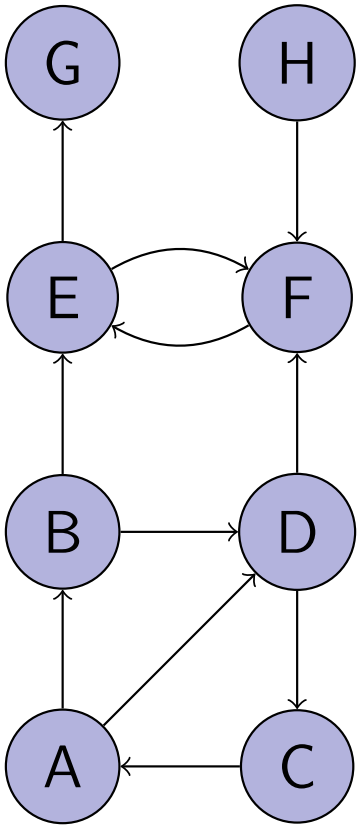
Subgraph of Social Graph of "Return of the King"



Source: http://visualizing.org/full-screen/112639

Give an example of a subgraph of the above graph that only includes hobbits (i.e. Frodo, Sam, Merry, and Pippin).

Exercise 4



Assume that each node is connected to itself with a self-loop (not shown).
What are the strongly connected components of the above graph?

Next Class

- Next class reading: Chapter 20: Graph Data Structures