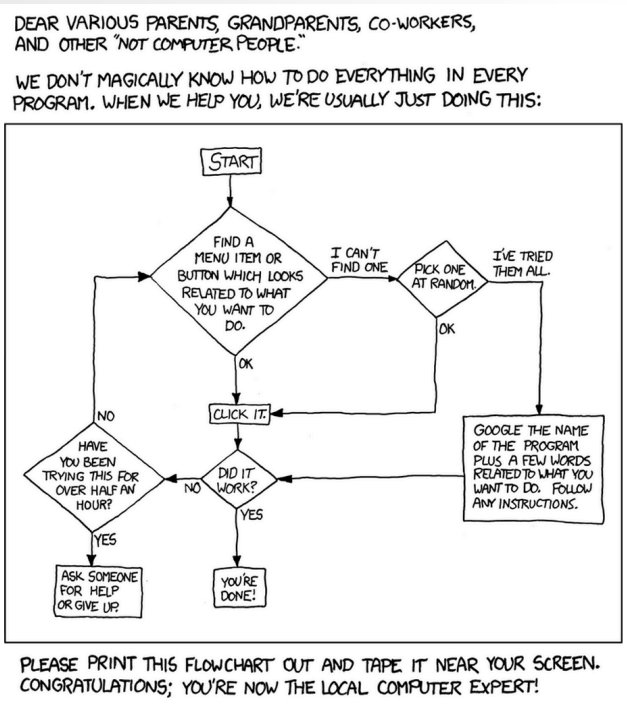
Graphs

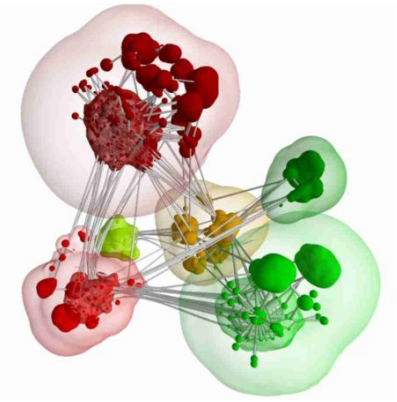
this is a flow chart, but it is similar to a graph

Snarf today's code



Today

- Our last topic
  - Intro to graphs
  - Coding with graphs



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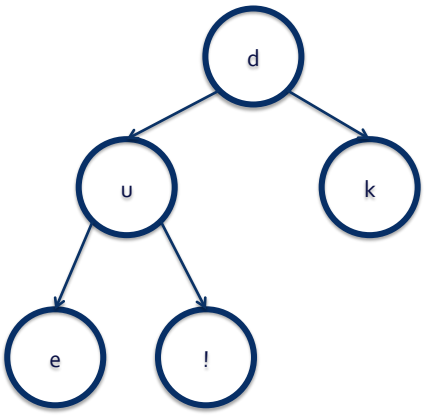
Trees



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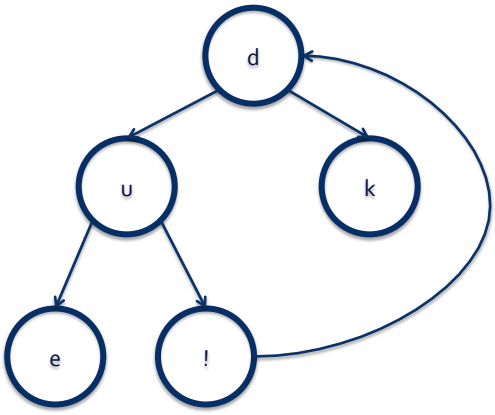
Graphs



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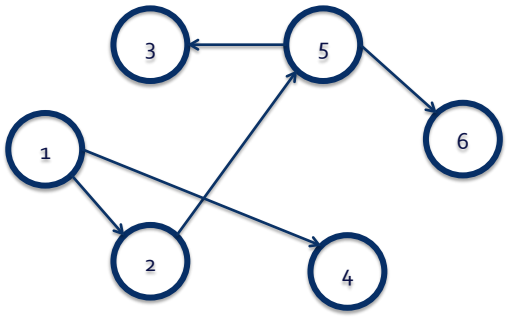
Graphs

- set of vertices
  - {1, 2, 3, 4, 5, 6}
- set of edges
  - {(1, 2), (1, 4), (2, 5), (5, 3), (5, 6)}



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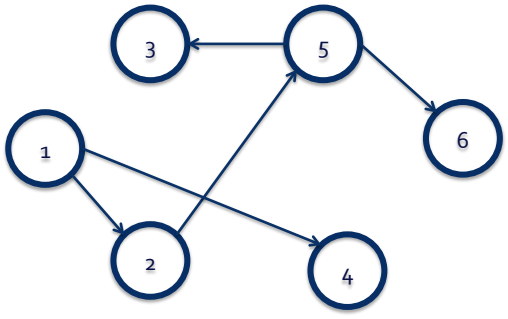
Graphs

- directed graphs* – edge sets are ordered
  - {(1, 2), (1, 4), (2, 5), (5, 3), (5, 6)}
  - 1 points to 2 – notice the arrow
  - (2, 1) is not an edge

*a.k.a. digraphs



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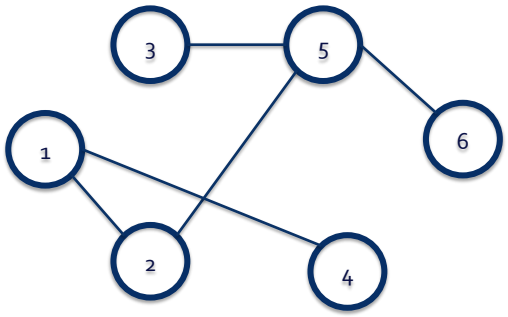
Graphs

- undirected graphs – edge sets are not ordered
  - {(1, 2), (1, 4), (2, 5), (5, 3), (5, 6)}
  - (1, 2) is the same as (2, 1)



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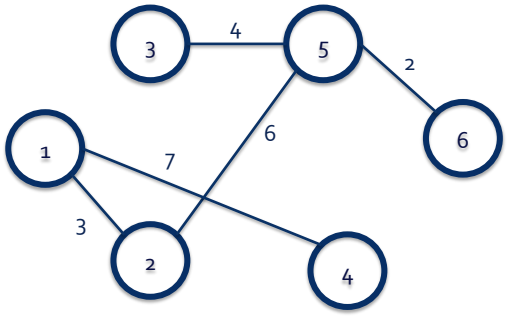
Graphs

- edges can have weights



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Graphs

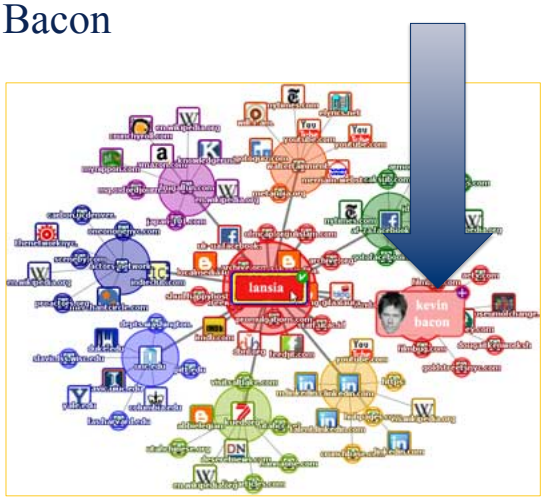
- Why do you care?

facebook

9

Graphs

- Kevin Bacon



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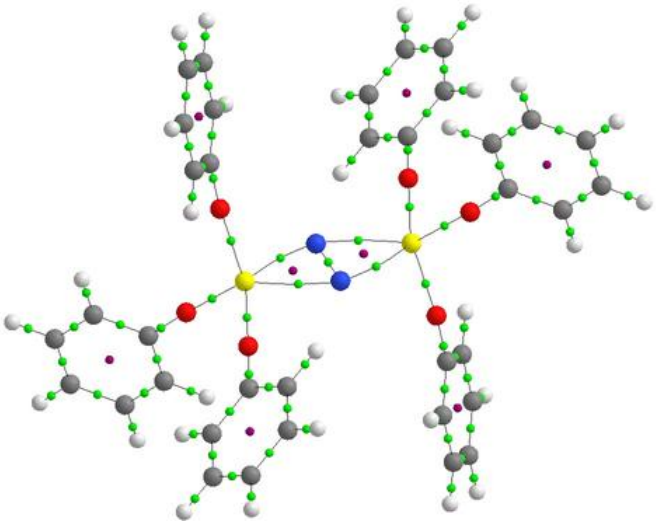
Graphs



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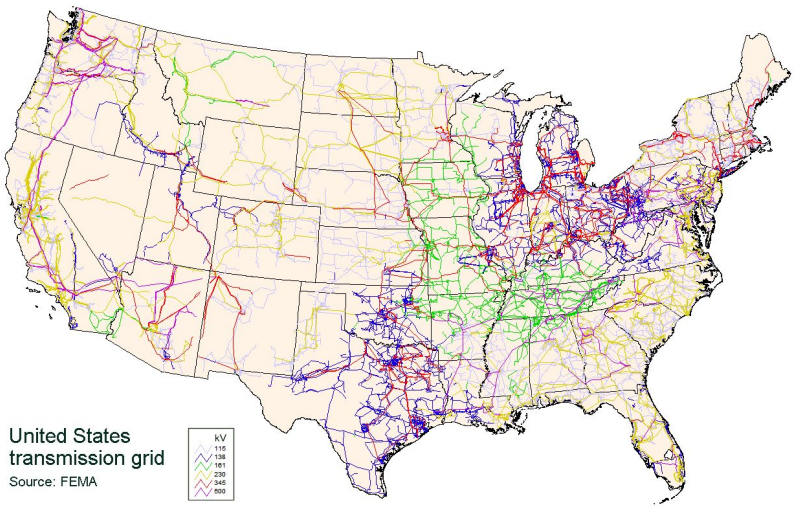
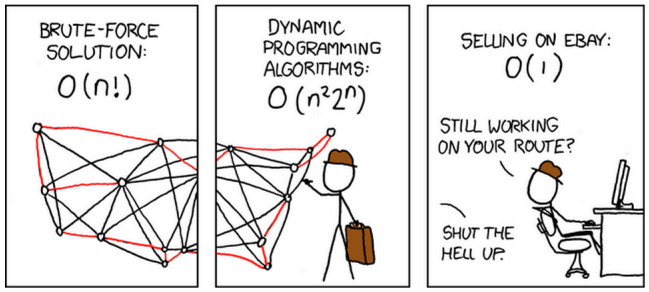
Graphs



12

Graphs

- Traveling salesperson problem
  - Given a list of cities and the distance between each pair of cities, what is the shortest possible route that visits each city exactly once and returns to the original city?



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Graphs

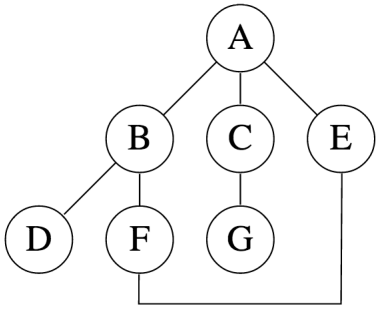
- Depth-first-search
  - explore as far as possible before backtracking

```
Start at root

dfs(vertex)
    if(visited vertex) return;

    visit vertex

    for(adjacent vertices to vertex)
        dfs(adjacent vertex)
```



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Graphs

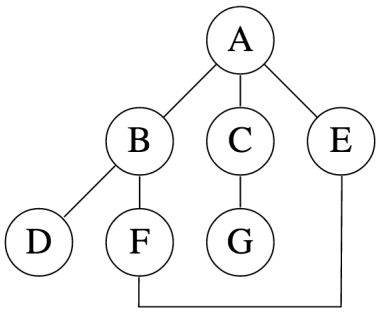
- Depth-first-search
  - explore as far as possible before backtracking

```
Start at root

dfs(vertex)
    if(visited vertex) return;

    visit vertex

    for(adjacent vertices to vertex)
        dfs(adjacent vertex)
```



A

15

Graphs

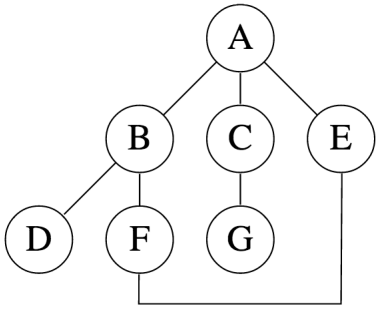
- Depth-first-search
  - explore as far as possible before backtracking

```
Start at root

dfs(vertex)
    if(visited vertex) return;

    visit vertex

    for(adjacent vertices to vertex)
        dfs(adjacent vertex)
```



A B

16

Graphs

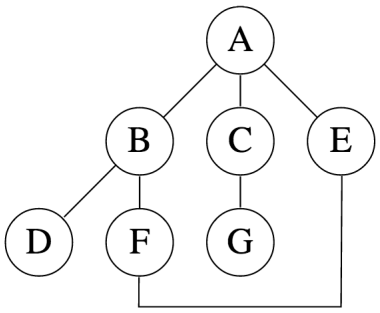
- Depth-first-search
  - explore as far as possible before backtracking

```
Start at root

dfs(vertex)
    if(visited vertex) return;

    visit vertex

    for(adjacent vertices to vertex)
        dfs(adjacent vertex)
```



A B D

17

Graphs

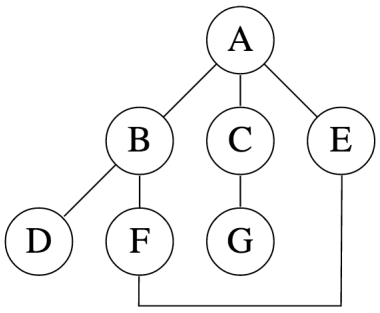
- Depth-first-search
  - explore as far as possible before backtracking

```
Start at root

dfs(vertex)
    if(visited vertex) return;

    visit vertex

    for(adjacent vertices to vertex)
        dfs(adjacent vertex)
```



A B D F

18

Graphs

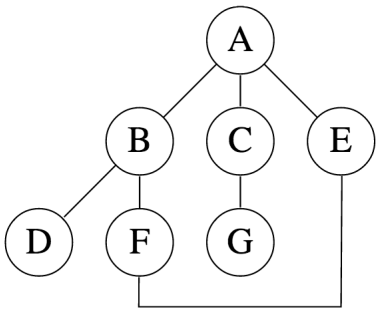
- Depth-first-search
  - explore as far as possible before backtracking

```
Start at root

dfs(vertex)
    if(visited vertex) return;

    visit vertex

    for(adjacent vertices to vertex)
        dfs(adjacent vertex)
```



A B D F E

19

Graphs

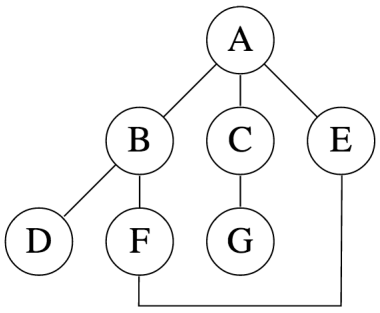
- Depth-first-search
  - explore as far as possible before backtracking

```
Start at root

dfs(vertex)
    if(visited vertex) return;

    visit vertex

    for(adjacent vertices to vertex)
        dfs(adjacent vertex)
```



A B D F E C

20

Graphs

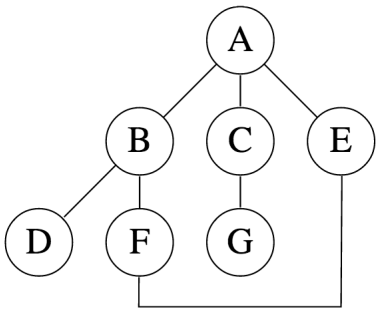
- Depth-first-search
  - explore as far as possible before backtracking

```
Start at root

dfs(vertex)
    if(visited vertex) return;

    visit vertex

    for(adjacent vertices to vertex)
        dfs(adjacent vertex)
```



A B D F E C G

21

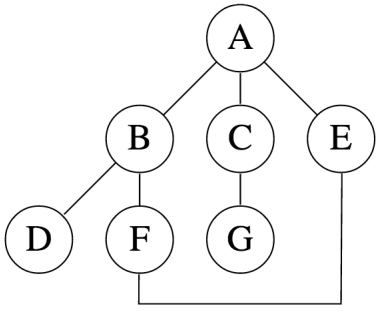
Graphs

- Breadth-first-search
  - explore as far as possible before backtracking

```
Start at root

bfs(vertex)
   myQ.enqueue(vertex)


   while(!myQ.isEmpty()
        v = myQ.dequeue
        for(adj vertices of v)
            if(adj not visited)
                myQ.enqueue(adj)
```



22

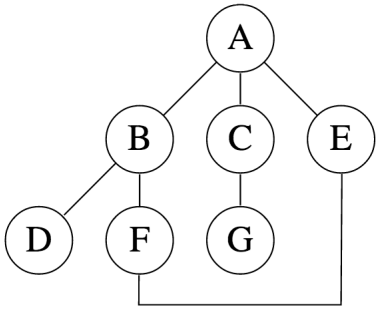
Graphs

- Breadth-first-search
  - explore as far as possible before backtracking

```
Start at root

bfs(root)
   myQ.enqueue(root)


   while(!myQ.isEmpty()
        v = myQ.dequeue
        for(adj vertices of v)
            if(adj not visited)
                myQ.enqueue(adj)
```



A

23

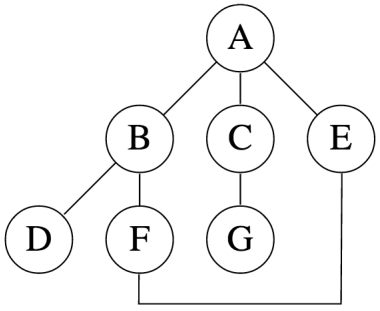
Graphs

- Breadth-first-search
  - explore as far as possible before backtracking

```
Start at root

bfs(root)
   myQ.enqueue(root)


   while(!myQ.isEmpty()
        v = myQ.dequeue
        for(adj vertices of v)
            if(adj not visited)
                myQ.enqueue(adj)
```



A B C E

24

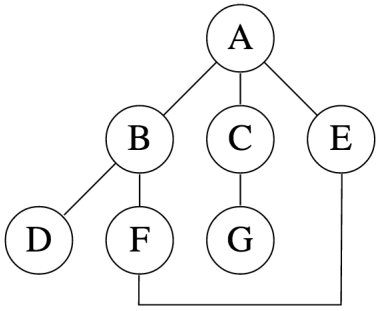
Graphs

- Breadth-first-search
  - explore as far as possible before backtracking

```
Start at root

bfs(root)
   myQ.enqueue(root)


   while(!myQ.isEmpty()
        v = myQ.dequeue
        for(adj vertices of v)
            if(adj not visited)
                myQ.enqueue(adj)
```



A B C E D F

25

Graphs

- Breadth-first-search
  - explore as far as possible before backtracking

```
Start at root

bfs(root)
   myQ.enqueue(root)


   while(!myQ.isEmpty()
        v = myQ.dequeue
        for(adj vertices of v)
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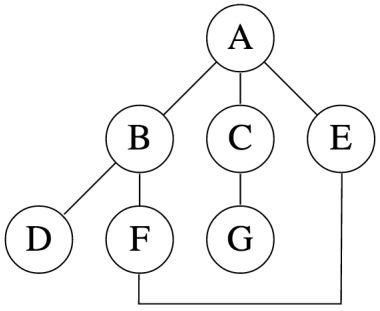

A B C E D F G

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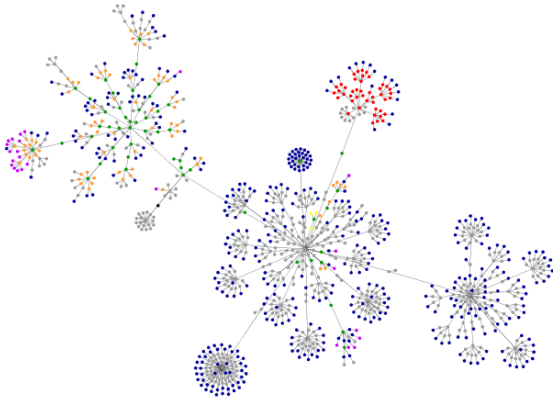
Code time

- snarf today's code
  - this will be helpful for APT set 7



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Before you go

- Today
  - Intro to graphs
  - Coding with graphs

- How are things going?

  - http://goo.gl/lo1e5x
    - (lower-case L, lower-case O, #1, e, 5, x)

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