• Midterm delay until Friday, April 17

• Discussion sections and lab exercises

• Assignment 7 due Wednesday midnight---questions?

• Schedule of future Assignments
A Bit More About Dictionaries and Tuples, and an Overview of the Next Assignment
1. Structure of the GUI Application

• Layout specified as list of lists.
• Infinite loop that monitors for ‘events’ (usually button clicks) and returns a tuple (string, dictionary) giving the source of the event, and the values associated with various objects in the layout.
• Dictionary ’effects’ whose key-value pairs are button names and functions.
• Functions as objects.

Look at the part of the photoshop code that you’re not supposed to touch!
2. Removing items from Dictionaries

- `del d[k]` does it.
- What if you need, say, to delete every item whose value satisfies some condition? For instance, if the values are ints, delete every item whose value is 0.
- Python does not let you change the size of a dictionary while iterating through it with for, so you need a different solution. (Iterate through `list(d)` or `list(items(d))`)

Demo
Next Assignment: Exploring the Collaboration Graph of Film Actors
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Long before Facebook.......
Next Assignment: Exploring the Collaboration Graph of Film Actors

The Small-World Problem
By Stanley Milgram

Fred Jones of Peoria, sitting in a sidewalk cafe in Tunis, and needing a light for his cigarette, asks the man at the next table for a match. They fall into conversation; the stranger is an Englishman who, it turns out, spent several months in Detroit studying the operation of an interchangeable-bottlecap-factory. “I know it’s a foolish question,” says Jones, “but did you ever by any chance run into a fellow named Ben Arkadian? He’s

Milgram, 1967, the Small-World Experiment
Next Assignment: Exploring the Collaboration Graph of Film Actors

‘Six Degrees of Separation’

https://www.youtube.com/watch?v=HLlyuYwbVnA
Next Assignment: Exploring the Collaboration Graph of Film Actors

‘Six Degrees of Kevin Bacon’
https://oracleofbacon.org/
Why is it called a collaboration *graph*?

- Graph—collection of vertices and edges
- Vertices are actors---an edge joins two actors if they have appeared in a film together.
- Collaboration distance = shortest path in the graph between two vertices. (Fundamental CS problem.)
Exploring the Collaboration Graph of Mathematicians

‘Erdös Number’
Step 1: You’ll be given a dictionary of films and their casts.

{‘Ford vs. Ferrari’:[‘Christian Bale’,’Tracy Letts’],
 ‘Little Women’:[‘Saoirse Ronan’,’Laura Dern’,’Meryl Streep’,’Tracy Letts’]...}
Step 1: You’ll be given a dictionary of films and their casts.

{‘Ford vs. Ferrari’: [‘Christian Bale’, ‘Tracy Letts’],

> 3000 films (but not these new ones!)

Use this dictionary to answer a lot of basic questions: How many movies? Which movie has the largest cast? Which actors appeared in both ‘Silver Linings Playbook’ and ‘American Hustle’? (These can usually be answered with a simple list comprehension.)

Demo.
Step 2: Make the inverted dictionary.

```json
{'Tracy Letts': ['Ladybird', 'Little Women', 'Ford vs. Ferrari'], 'Laura Dern': ['Little Women', 'Marriage Story'],...
```

Ford vs. Ferrari -> Christian Bale
Little Women -> Tracy Letts
Ladybird -> Saoirse Ronan
Marriage Story -> Laura Dern, Meryl Streep, Scarlett Johansson, Adam Driver
Step 2: Make the inverted dictionary.

{"Tracy Letts":[‘Ladybird’,‘Little Women’,‘Ford vs. Ferrari’],‘Laura Dern’:[‘Little Women’,‘Marriage Story’],‘Adam Driver’:[‘Marriage Story’]… }

Use this dictionary to answer a lot of basic questions: How many actors? Which actor has been in the largest number of movies? How many movies has Owen Wilson been in? How many actors have last name ‘Wilson’?
Step 3: Use the two together to create a dictionary representing the (unlabeled) collaboration graph

Use it to answer still more questions: Has Kate Winslet been in a film with Nicole Kidman? Or been in a film with someone who has been in a film with Nicole Kidman? Who has the most collaborators?

{"Kate Winslet':[‘Lena Olin’,’Johnny Depp’],’Lena Olin':[‘Johnny Depp’,’Kate Winslet’],’Johnny Depp':[‘Lena Olin’,’Kate Winslet’,’Charlie Sheen’],’Charlie Sheen':[‘Johnny Depp’]}

Step 4: Use ‘breadth-first search’ to find the shortest path between two actors

Distance 0 from A
Step 4: Use ‘breadth-first search’ to find the shortest path between two actors
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As breadth-first search proceeds, we keep track of the predecessor of each vertex that is added. This lets us reconstruct the shortest path: G-D-B-A is shortest path from G to A.
Demo of completed version, both labeled and unlabeled version.
How is the original dictionary ’provided’?
‘Pickling’

If you create a complex data structure (e.g., dictionary with strings as keys and lists of tuples of strings as values...) you don’t want to have to rebuild it every time you want to play ‘Six degrees of Kevin Bacon’.

Python ‘pickle’ module provides a way to save such structures as a file and to recover them directly from the file.

demo
Data wrangling

The original data sources online are in a variety of formats: embedded in web pages, in `.csv` files (basically spreadsheets), in XML format, in JSON format.

Python has built-in tools for reading and processing files in these formats and importing them into Python data structures like lists and dictionaries.

Demo:  Data import from CSV and JSON files.