INTRODUCTION TO BUSINESS DATA ANALYTICS WITH EXCEL

COURSE SYLLABUS

Fall 2019

Class Hours  Tuesday and Friday, 9:30-11:00 a.m.

Location  Mandel G-12

Office  Lemberg 246

Office Hours  Schedule with calendly.com/philippewells. Regular scheduling options available Tuesday 1-3pm. Please email me if you need to schedule at a different time.

TA  TBD

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BUS 51a Business Data Analytics with Excel

Course description and learning outcomes
This course is the introductory quantitative methods class for the business major. The objective of the course is to teach students how to analyze data, how to create data visualizations, and how to use data for basic inference. The course is taught using Microsoft Excel, thus allowing students to also learn the most common piece of software used in the workplace to analyze business data.

There are six primary learning outcomes for students:

1. You will learn the basics of statistics, probability and data inference.
2. You will obtain Excel skills at a level that is necessary for any entry level position in business.
3. You will learn to analyze datasets using Excel tools.
4. You will learn the basics of data visualization. i.e., you will learn to present data and data analysis in intuitive and meaningful ways.
5. You will learn the basics of Tableau for data visualizations.
6. You will learn the basics of regression analysis.

Materials
The textbook for this class is Business Analytics (BA), Cengage, 3rd Edition. The course syllabus refers to the chapters in BA, and the lectures cover the material as it is presented in the textbook. All individual problem sets are based on the problems in the textbook. For the second part of the course, you will purchase two Harvard Business Publishing (HBP) case studies. After the start of the semester, I will share the link to purchase your HBP case studies. You will also receive an email link (from Tableau) to sign up for your Tableau license.

Teaching Methods
The lectures in this course assume that you have already gained exposure to the material through the textbook. Excel is best learned by doing. I will make frequent use of in class examples and in class exercises to convey the material. The individual assignments are designed to provide extensive hands-on experience with Excel. The presentations will require significant Excel data preparation and manipulation similar to the types of analyses required in a business environment. The presentations themselves will allow you to become more comfortable with ways of communicating your data insights, and will help you determine how to most effectively share an analytical story.

Who should be taking this course?
This is a required course for all business majors at Brandeis University. Even if this course can be exempted by taking similar courses in other departments in the University, we strongly recommend that students with an interest in business take this course as it will teach the Excel skills required in the workplace.
**Expected workload**
Students should expect to invest 9 hours per week outside of class on the course. This course relies heavily on the preparatory work that students do on their own with the textbook.

**Grading**
The overall composition of the final grade is as follows:

- **Class Participation** 10%
- **Assignments** 40% (20% Team + 20% Individual)
- **Midterm** 20%
- **Capstone Project** 30%

**Class Participation (10%)**
Thinking through problems and being able to work on them in real time is an important aspect of data analysis in a business environment. Even when it comes to Excel, there is not always one correct answer. Often, there are several ways to solve a problem. By participating in class discussion you will familiarize yourself with different analytical approaches, and you will learn to solve problems on your own as well as part of a team.

**Note:** You are permitted two absences for any reason (e.g., illness, family celebration, job interview, varsity sports, unfavorable airline schedule, you forgot to set your alarm); for each additional absence, your letter participation grade will be reduced by one grading notch, e.g., A- becomes A-/B+, and so on. If you have perfect attendance but rarely participate in class, your participation grade will be C.

**Individual Assignments (20%)**
There are three assignments, to be done individually (without assistance from anyone). The assignments will be posted to LATTE on
- Friday, September 6 Due Friday, September 13
- Tuesday, September 17 Due Tuesday, September 24
- Tuesday, October 8 Due Friday, October 18
Assignments are to be submitted electronically, to your TA, by the start of class on the due date. Late assignments will result in a grade deduction.

**Regression Analysis Presentation (10%)**
Given in teams of 5 students on Friday, October 4. Teams will be assigned during class on Friday, September 20.
Each presentation (on a topic you will select from a list posted to LATTE) should last 8-10 minutes, plus time for Q&A. Please inform me by email by 8 p.m. on Wednesday, September 25, what your proposed topic will be. I will let you know the following day if that topic has already been selected by another team. Every team must email me their PPT deck by 9:30am, Friday, October 4.
Midterm Exam (20%)
This is a written open-book exam that will take place during normal class hours, location TBD, on Friday, October 25. You will be asked questions about the materials covered in class and the textbook chapters assigned through October 22.

Financial Scenarios Presentation (10%)
Given in teams of 5 students on Friday, November 8. Teams will be assigned during class on Tuesday, October 29. Please inform me by email by 8 p.m. on Wednesday, October 30, what your proposed company will be. I will let you know the following day if that company has already been selected by another team. Every team must email me their PPT deck by 9:30am, Friday, November 8. Here is the scenario: You are looking for an exciting internship opportunity at an interesting company. You want to be well informed about the company when you contact them. To that end, you use your Excel skills to build a financial model for the company. Choose a company that is big enough to host an internship program, but not so big that you can’t get a good feel for the whole company over the course of an internship. Find a company with a market capitalization between USD 500 million and USD 2 billion. Use any screening tool you like to identify your choice. Finance.yahoo.com and finbox.com are two sites out of many that you can use. “Bloomberg” is always an option for a company screen like this. Your Excel model for the company will include annual data for the last five years. Download financials from the investor relations section of the company website (for example, to get Apple financials, you would go to: investor.apple.com/sec-filings/default.aspx). The presentation must:

- Set up an Excel model for the company that includes five years of annual data (through 2018) for income statement, balance sheet, and cash flow statement.
  - Make simplifying assumptions where needed to complete your model.
    - Note your assumptions.
  - Include the model in your PPT data appendix.
- Generate charts and graphs to display how the company has done historically.
  - Try to break down the overall picture and get a sense of how different segments or regions of the company are doing (assuming they break this information out separately).
    - Some of this information might come from the notes in the financial statements
    - What shifts are taking place within the business?
  - Create 2-3 PPT slides.
- Use the Excel “Scenario Manager” under What-if-Analysis to create a pivot table with three different business scenarios for next year’s (2020) sales, gross margin, operating expenses, and net income.
  - Link your scenarios to real world situations
    - Scenarios can reflect changes in trade tensions, commodity price swings, etc.
Your scenarios will entail different assumptions about revenue growth, growth by sector or region, profitability ratios, etc.

Explain your scenarios and describe their assumptions
  ○ Generate 3-4 PPT slides.

Put your model, charts, and thoughts together in a PowerPoint presentation. As a group (make sure each team member speaks), present your company to the class. Show what you think is compelling about it. Talk about the story the financials tell. Present your insights about the business drivers. Explain how the different scenarios affect future potential outcomes. This is a data and model driven presentation. Be sure to tie your thoughts back to the numbers. At the same time, try to tell a story that makes the numbers come alive. The Powerpoint deck is due by 9:30 a.m., Friday, November 8.

Notes
  ● Grades on team projects are assigned to all members of the team, though I reserve the right to alter individual grades if it is clear that an individual did not contribute to the assignment in a consistent and meaningful way.

  ● **Sending emails to me on team deliverables:** To avoid deductions, always “cc” all of your team members on emails (using everyone’s @brandeis.edu email address) - and only send me one email per team for each deliverable. In the subject line of the email, note your team name, followed by the deliverable (e.g. Team Blue, Final PPT or Team Blue, Proposed Company).

**Capstone Project (30%)**
The Capstone project is an opportunity to present an in-depth financial and fundamental analysis of a business sector of your choice. To be completed in teams of 3 students. Please inform me by email by 8 p.m. on **Friday, November 8**, who is on your team, what your team name is, and what your proposed companies will be. I will let you know the following day if those companies have already been selected by another team. Every team must email me their PPT deck by **9:30am, Friday, December 6**.

You have decided to utilize your Excel skills by starting a business analytics consulting firm. You want to carve out your own niche as you get your firm up and running, and have therefore chosen to focus on one particular business sector. In order to market your new firm, you decide to organize and host a business sector conference where you can present your skills. You will give an analytical and data driven overview of trends in the sector. You have separately invited customer and product experts to talk about those aspects of the industry so your presentation can focus on data, financials, and analytics. The presentation must:

  ● Feature a business sector that has at least three publicly traded companies.
    ○ You may first want to choose a company that interests you, and then make sure there are at least two other companies in the same sector.

  ■ Websites like craft.co and owler.com are helpful tools to identify competitors for a particular company.
• Build Excel models of **income statements only** for the three companies.
  ○ The models must include quarterly data from 2015-2018 (16 quarters of data).
    Download the raw data from the company investor relations sites.
  ○ Create PPT slides for your data appendix.
• Analyze some of the **comparative** trends you see in the data using statistical tools from this course.
  ○ Produce charts, scatterplots, histograms, etc. that **compare** the companies’ performance over time.
  ○ With four years of quarterly data, you now have several 16 point time series - on revenues, profitability, etc. - that you can use for regression analysis.
    ■ Set up a time series regression model to explain one dependent variable of your choice.
      ● Run the regression three times (once for each company).
      ● Use dummy variables for quarterly seasonality, as well as a dummy variable for the trend over time (on a quarterly basis).
      ● Also include a fundamental driver as one of your explanatory variables, something like the growth of e-commerce, the price of gas, the level of retail inventories, or something else. Make sure this explanatory variable is available on a quarterly basis so it matches the time frequency of the rest of your dataset.
  ○ Create 3-4 PPT slides.
• Identify one or two more industry drivers (in addition to the one already used in the time series regression), and plot all of your industry driver data back to 1990 (if that amount of historic data are available).
  ○ “Bloomberg” is a good source for these types of data series.
  ○ No more regression analysis for this. Just chart the data.
  ○ Include this information in 2-3 PPT slides.
• Use your regression models to project your dependent variable for the four quarters of 2019 for each of the three companies.
  ○ You will need to come up with an estimate for your fundamental driver for some of the quarters.
  ○ Compare your projections to the actual numbers for the first two quarters, and note how confident that makes you feel about the validity of the next two quarterly projections.
  ○ This analysis should take up 2-3 PPT slides.

*Significance of the company Excel models.* Your Powerpoint presentation should focus on broader themes. This presentation is not meant to be a cell-by-cell discussion of company financials and formulas. The detailed company models should be included in the appendix to your Powerpoint deck. The models do not have to include every single detail broken out in the public financials. If you are looking at a very complex company like GE, for instance, include as much line item detail as you think
is helpful to understand and build intuition, but don’t include items that are overly specific and that you can’t really fully assess as a company outsider.

*Style of presentation.* Put your model, charts, and thoughts together in a PowerPoint presentation. As a group (make sure each team member speaks), present your insights to the class. The objective of your financial and fundamentals analysis is to gain a deeper understanding of the business, the companies, the history, and the potential future evolution of the sector. Your slides should summarize what you see in your detailed models. You can include individual numbers and trends from the models in your presentation as a way to make your points about the dynamics of the sector and its growth and profitability prospects. Don’t do a data dump. Only use the data needed to tell your story.

*Presentation structure.* Without the data appendix, your Powerpoint deck should include 7 - 10 slides. The purpose of your presentation is to give a sense of current trends within the sector, both individually for the companies as well as comparatively for the business overall, as well as for the three competitors. The projections portion of the presentation is meant to highlight the sector outlook from the perspective of each of the competitors.

*Goal and conclusions.* Your conclusions are meant to provide useful information for company management. Your insights can be used for business strategy recommendations, but at this stage, you are focusing on the analytical portion of the work. Your presentation is intended to give a sense of (1) how the companies are performing, (2) what the regression analysis indicates, (3) how the fundamental drivers of the industry have evolved, and (4) what this implies for the next few quarters.

The Powerpoint deck is due by 9:30 a.m., Friday, December 6.

**Note:** One of the three companies you analyze may be the same one you chose to look at for your Financial Scenarios Presentation.

**Disabilities**
If you are a student with a documented disability on record at Brandeis University and wish to have a reasonable accommodation made for you in this class, please see me immediately before or after the first class.

**Academic Integrity**
You are expected to be honest in all of your academic work. Please consult Brandeis University *Rights and Responsibilities* for all policies and procedures related to academic integrity. Students may be required to submit work to TurnItIn.com software to verify originality. Allegations of alleged academic dishonesty will be forwarded to the Director of Academic Integrity. Sanctions for academic dishonesty can include failing grades and/or suspension from the university. Citation and research assistance can be found at LTS - Library guides.
Submissions
All work must be submitted before the required date and time. Only with my prior approval will late work be allowed, and that is only in exceptional circumstances.

Absences
The class discussions are not limited to what is in the textbook. Therefore, if you are absent, it is your responsibility to ask a peer for their class notes and read the textbook to catch up. You are permitted up to two absences for any reason; for each additional absence, your grade will be reduced.

Teamwork
You will be assigned to teams and each team member is expected to contribute equally to all team assignments. If this does not occur, it will impact that team member’s grade.

Midterm
You will have one midterm exam which covers Sessions 1-13. No make-up exams will be permitted.

Technology
Bring laptops to every class. Please put away all other electronic devices (and keep on silent mode) for the duration of class.

Course Outline

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<th>Assignments</th>
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<td>1</td>
<td>Fri, 8/30</td>
<td>Describing and Visualizing Data</td>
<td><strong>BA: Chapter 1</strong></td>
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<td>Visit <a href="https://www.census.gov/dataviz/">https://www.census.gov/dataviz/</a>, <a href="https://www.data.gov/">https://www.data.gov/</a>, <a href="https://www.mpaa.org/research-policy/">https://www.mpaa.org/research-policy/</a> For instructions, see p.12 of this syllabus</td>
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<td>Tues, 9/3</td>
<td>Descriptive Statistics</td>
<td><strong>BA: Chapter 2</strong></td>
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<td>● Types of Data</td>
<td>Familiarize yourself with Excel Basics using Lynda online through the Brandeis Library website: <a href="https://www.lynda.com">Excel 2016 Essential Training: Chapters 1-5</a></td>
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<td>● Sorting and Formatting</td>
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<td>● Frequencies and Histograms</td>
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<td>3</td>
<td>Fri, 9/6</td>
<td><strong>Data Visualization</strong></td>
<td><strong>BA: Chapter 3</strong>&lt;br&gt;Lynda Excel 2016 Essential Training: Chapter 7 (Charts).&lt;br&gt;Individual problem set 1 (4%) assigned. To be submitted electronically, to your TA, by 9:30 a.m. Friday, 9/13.</td>
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<td>4</td>
<td>Tues, 9/10</td>
<td><strong>Descriptive Data Mining</strong></td>
<td><strong>BA: Chapter 4</strong></td>
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<td>5</td>
<td>Fri, 9/13</td>
<td><strong>Probability</strong></td>
<td><strong>BA: Chapter 5</strong>&lt;br&gt;Individual Problem set 1 due. Submit electronically to your TA by 9:30 a.m..</td>
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<td>6</td>
<td>Tues, 9/17</td>
<td><strong>Hypothesis Testing</strong></td>
<td><strong>BA: Chapter 6</strong>&lt;br&gt;Individual problem set 2 (8%) assigned. To be submitted electronically, to your TA, by 9:30 a.m. Tuesday, 9/24.</td>
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<td>7</td>
<td>Fri, 9/20</td>
<td><strong>Statistical Inference</strong></td>
<td><strong>BA: Chapter 6</strong>&lt;br&gt;Teams for Regression Analysis Presentation assigned in class.</td>
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<td>8</td>
<td>Tues, 9/24</td>
<td><strong>Linear Regression</strong></td>
<td><strong>BA: Chapter 7</strong>&lt;br&gt;Individual Problem set 2 due. Submit electronically to your TA by 9:30 a.m.&lt;br&gt;Team Project 1 : Regression Analysis Presentation topics posted to LATTE.&lt;br&gt;Email me your proposed topics by 8 p.m. on Wednesday, 9/25.</td>
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<td>Class</td>
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<td>9</td>
<td>Fri, 9/27</td>
<td><strong>Linear Regression</strong></td>
<td><strong>BA: Chapter 7</strong></td>
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<td>● Goodness of Fit and Prediction</td>
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<td>● Excel Analysis ToolPak</td>
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<td>10</td>
<td>Fri, 10/4</td>
<td><strong>Regression Analysis Presentations</strong></td>
<td>Team Presentations. PPT decks to be submitted to me electronically by 9:30 a.m.</td>
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<td>11</td>
<td>Tues, 10/8</td>
<td><strong>Modeling in Excel</strong></td>
<td><strong>BA: Chapter 10</strong></td>
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<td>● Spreadsheet Modeling</td>
<td>Individual problem set 3 (8%) assigned. To be submitted electronically, to your TA, by 9:30am Friday, 10/18.</td>
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<td>● What-If Analysis</td>
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<td><strong>Time Series and Forecasting</strong></td>
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<td>● Time Series</td>
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<td><strong>Predictive Analytics</strong></td>
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<td>● Data Preparation and Partitioning</td>
<td>Individual problem set 3 due. Submit electronically to your TA by 9:30am.</td>
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<td>● Logistic Regression</td>
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<td>Midterm Review</td>
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<td>15</td>
<td>Fri, 10/25</td>
<td>Midterm</td>
<td>Exam will cover everything we have done to date; the exam is open book, so bring all course materials and notes, as well as a laptop.</td>
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<td>16</td>
<td>Tues, 10/29</td>
<td><strong>Modeling in Excel</strong></td>
<td><strong>BA: Chapter 10</strong></td>
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<td>● Company Financials</td>
<td>Teams for Financial Scenarios Presentations assigned in class. Email me your proposed company by 8 p.m. on Wednesday, 10/30. PPT decks due by 9:30am, Friday, 11/8.</td>
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<td>● Assumptions</td>
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<td>17</td>
<td>Fri, 11/1</td>
<td><strong>Applied Multivariate Regression Analysis</strong></td>
<td>HBS note “Regression Analysis” (David Bell)</td>
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<td>18</td>
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<td><strong>Multivariate Regression Analysis</strong></td>
<td><strong>BA: Chapter 7</strong></td>
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<td>● The Multiple Regression Model</td>
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<tr>
<td>19</td>
<td>Fri, 11/8</td>
<td>Financial Scenarios Presentations</td>
<td>Team Presentations. PPT decks to be submitted to me electronically by 9:30 a.m. Come up with your 3 person teams for the Capstone Presentation. <strong>Email me your proposed team members, team name, and companies by 8 p.m. on Friday, 11/8.</strong> PPT decks due by 9:30am, Friday, 12/6.</td>
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<tr>
<td>20</td>
<td>Tues, 11/12</td>
<td>Advanced Data Visualization</td>
<td>● Introduction to Tableau&lt;br&gt;● Pivot tables and Tableau&lt;br&gt;● Basic tables</td>
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<td>21</td>
<td>Fri, 11/15</td>
<td>Advanced Data Visualization</td>
<td>● Graphs&lt;br&gt;● Maps&lt;br&gt;● Creating a Dashboard on Tableau&lt;br&gt;● Creating a Storyboard on Tableau</td>
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<td>22</td>
<td>Tues, 11/19</td>
<td>Connection to Other Software</td>
<td>● R, R Studio, GIS</td>
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<td>23</td>
<td>Fri, 11/22</td>
<td>Case Analysis</td>
<td>HBS case “Store24”</td>
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<td>24</td>
<td>Tues, 11/26</td>
<td>Linear Optimization</td>
<td><strong>BA: Chapter 12</strong></td>
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<td>25</td>
<td>Tues, 12/3</td>
<td>Decision Analysis</td>
<td><strong>BA: Chapter 15</strong></td>
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<td>26</td>
<td>Fri, 12/6</td>
<td>CAPSTONE PROJECT SECTOR ANALYSIS PRESENTATIONS</td>
<td><strong>Capstone Project Presentations.</strong> Business attire is <strong>required</strong>, even if you are not presenting. <strong>Every team must email me their PPT deck by 9:30 a.m. on 12/6.</strong></td>
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<td>27</td>
<td>Tues, 12/10</td>
<td>CAPSTONE PROJECT SECTOR ANALYSIS PRESENTATIONS</td>
<td><strong>Capstone Project Presentations.</strong> Business attire is <strong>required</strong>, even if you are not presenting.</td>
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For our first class, on 8/30, please look at the following sources of data:

**US census data visualization site:**
https://www.census.gov/dataviz/

Look at the Data Visualization Gallery page for 2 minutes, scrolling down the various thumbnails. Write down your immediate reactions. Now, explore the “Where do college graduates work?” Data Visualization. Hover over different parts of the graph. What strikes you as interesting?

**Data.gov:**
https://www.data.gov/

Data.gov is a federal open government data access site. It is the new (established in 2009) face of federal government data. Look for information on the movie industry. **This will take a few clicks.** The movie industry represents a small share of the economy, so we will need to drill down quite a bit.

Search for “2012 economic census” in the landing page search box of data.gov. When you are on the results page, click the second link from the top, “Economic Census”. After you are taken to the next page, click “visit page”. Then, under Data Tables, click “View All Data Tables”. Then click on “2012 Information (NAICS Sector 51)”. Now, scroll down to “Core Series”, and click on the first link (Core Business Statistics Series: Comparative Statistics for the US and the States). You should now be looking at the data. Check out the download link, and download the data as a .csv file. You don’t need to open the file. Did the download work? Now go back to your browser and scroll to the line that says: “Motion picture and video industries.” What were sales in 2012? How did that compare to sales in 2007? Scroll around for two more minutes. What else do you notice?

**MPAA (Motion Picture Association of America):**
https://www.mpaa.org/research-policy/

The federal government focuses on collecting data for a wide range of industries. For more detailed information about an individual industry, in this case, the movie industry, we have to look elsewhere. Often, the industry trade group will collect data on an annual basis.

Scroll down the research and policy page, click on “Research Reports”, and click on the 2018 THEME report link. When it takes you to the page, click the button “View/Download” Spend 5 minutes scrolling through the report.

- What can you say about subscription video subscriber numbers compared to cable subscriber numbers?
- What do you notice about the mix of US Home Entertainment Consumer Spending on digital vs physical?
  - What is the overall trend in spending (digital and physical combined)?

There’s nothing to hand in; just bring your written comments to class and we will discuss them.