LOBSTER LAND

AD654: Marketing Analytics

Administrative Notes

Homework #3: Due <u>Sunday the 14th</u> (*not* original due date)

If you hit a syntax error at the last minute? Scoop up partial points! State the purpose of that particular step.

Font Bounty: "The person from Step deleted (Gill Sans)

Student: "But I can't do step X if I didn't solve Step W..."
Prof: "You can still explain Step X..."

Next Thursday, the 18th is a BU "Wellness Day." No classes, no meetings, no due-outs.

Thursday the 25th: Quiz #2 (Scope defined on next slide)

Quiz #2: Scope

Class Slides from Classes 5, 6, and 7

Expect to see more open-ended problems this time
For most model metrics, remember that I will have to give you the 'positive' outcome class
"Of the people who were labeled 'subscriber' by the model..."
Word problems are all about the setup.
Pacing: Be mindful of time – don't leave any multiple choice blanks
Basic structure will be the same as with Quiz #1 (timing, window, etc.)

Stukent Textbook: Chapter 12

Terminology questions? *Book & slides are the source*
Not all questions will be a pure 'word search'

How many noodles are in this jar? Don't think too hard about this -- just write your best-guess estimate. **Do not answer in chat.**

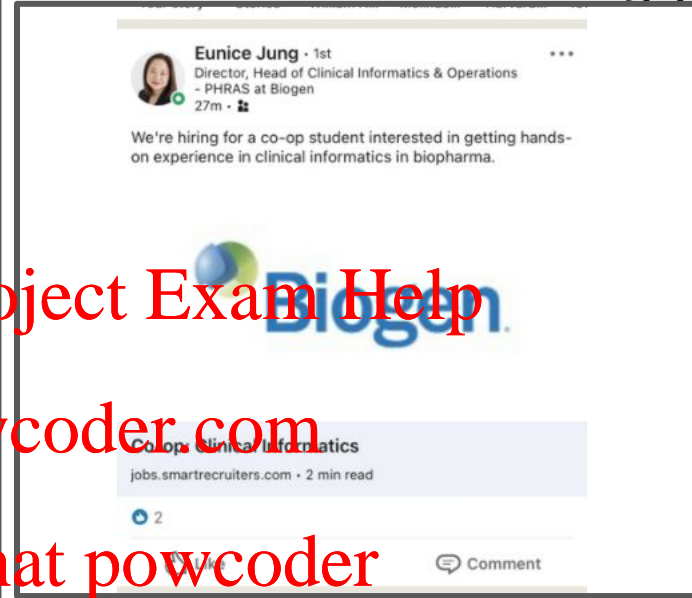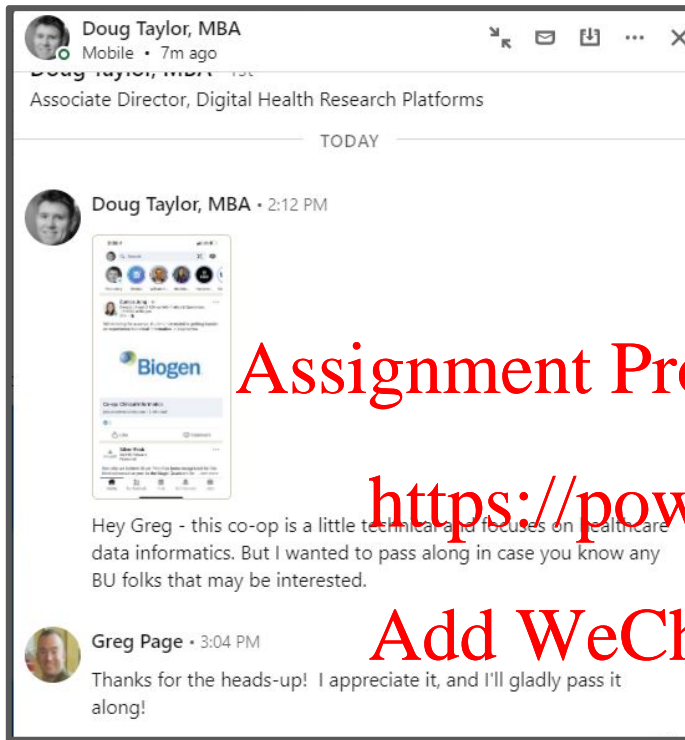Use the Google Poll to answer: https://forms.gle/aJCdaJA7TeX61cFm8

The teaching team will calculate our average after class, and I'll post the closest guess as well as the class average.

My prediction? The overall class mean will be far better than most individual guesses.

Doug Taylor, MBA
Mobile · 7m ago

Doug Taylor, MBA · 1st
Associate Director, Digital Health Research Platforms

TODAY

Doug Taylor, MBA · 2:12 PM

Hey Greg - this co-op is a little technical and focuses on healthcare data informatics. But I wanted to pass along in case you know any BU folks that may be interested.

Greg Page · 3:04 PM
Thanks for the heads-up! I appreciate it, and I'll gladly pass it along!

Eunice Jung · 1st
Director, Head of Clinical Informatics & Operations - PHRAS at Biogen
27m ·

We're hiring for a co-op student interested in getting hands-on experience in clinical informatics in biopharma.

Biogen

Co-op: Clinical Informatics
jobs.smartrecruiters.com · 2 min read

2   Comment

Are YOU that person? Who knows. If you think you *might* even be interested, why not apply? Here are two powerful things that I have witnessed: (1) the amount of **learning** that occurs THROUGH the job search; (2) the **networking** impact of the job search itself (by searching/applying/interviewing, you will directly meet people who work in the field).

Metrics in Our Lives

What impact does it have on you when you:

- **Track your personal spending?**

- **Track the number of steps you take in a day?**

When Metrics Backfire

Metrics may start the right way, but turn into a monster:

- Wells Fargo -- new account scandal
  - **Good idea**: Incentivize local branches to open more customer accounts
  - **Monster**: High pressure on local managers leads to questionable ethical decisions

- Campbell's Soup -- "loading the trade"
  - **Good idea**: Measure cans offloaded from loading dock as a sales metric
  - **Monster**: Strong incentive to move soup cans off the loading dock leads to... desperate measures!

- Enron -- mark-to-market accounting/dealmaking
  - **Good idea**: Use mark-to-market accounting to reflect fluctuations in energy asset values
  - **Monster**: Company can abuse mark-to-market when it simply decides on the value of the deal

- Inbound telephone support -- call duration as success metric
  - **Good idea**: Measure success of call center technicians by average call duration (shorter = better), because customers call them to solve problems!
  - **Monster**: Call center techs are incentivized to end calls quickly -- perhaps TOO quickly!

> Metrics can start the right way but turn badly...you can't turn off the human analysis input!

Chapter 12

Assignment Project Exam Help

Marketing Analytics

https://powcoder.com

Metrics

Add WeChat powcoder

Learning Objectives

- Define marketing analytic metrics
- Understand the role of analytics in regularly assessing a firm's overall marketing strategy
- Define a number of strategic, support and development metrics for marketing

Assignment Project Exam Help

https://powcoder.com

Add WeChat powcoder

What are marketing analytics metrics?

- They are measures of a data-driven project to maximize marketing effectiveness.

- Understand marketing analytics metrics allows marketers to maximize their efficiency and minimize marketing costs.

- Marketing analytics metrics are ways to assess a **marketing analytics strategy.**

STUKENT

What is marketing analytics strategy?

- Planning a data-driven project to maximize marketing effectiveness

- Allows marketers to maximize efficiency and minimize marketing costs

- Process to accurately report on the past, analyze the present, and predict the future

11

STUKENT

Marketing Campaign Life Cycle

The Process of creating and running a campaign through several stages:

1. **Design**
   - Starts with exploratory research
   - Social media analytics (likes, retweets, shares, etc.)

2. **Implementation**
   - Time to do everything to ensure success of campaign
   - AB Tests are useful doing this stage

3. **Evaluation**
   - Compare results to original goals

STUKENT

https://kerinmarketing.com/category/classroom-activities/page/2/

The Life Cycle of
One Impactful
Piece of Content

Connects to this one
piece of content

Express Writers

Decides to
visit our site

Contacts us

Becomes a loyal customer
within 5 days

New article
on column

Visitor reads
column

Assignment Project Exam Help

https://powcoder.com

Add WeChat powcoder

stukent
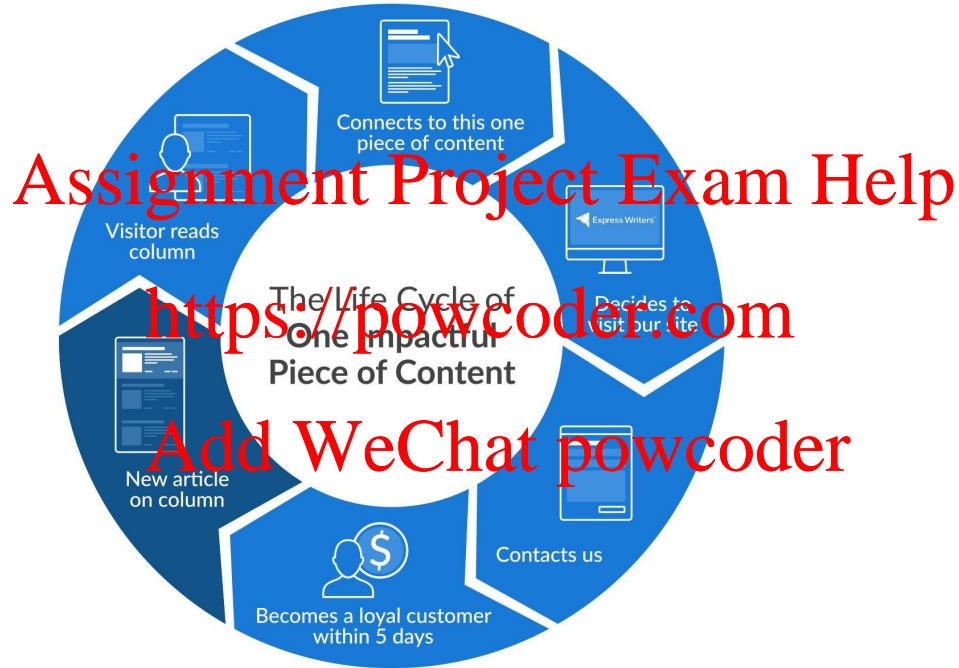
Design

- ▷ **Often starts with exploratory research**
  - Coke→ custom built listening software
    - Find out what is going on; likes, shares, comments
- ▷ **Form hypotheses about which strategies work well and which do not**

Assignment Project Exam Help

https://powcoder.com

Add WeChat powcoder

STUKENT

Implementation

- **Ensure the success of the campaign**
  - Coke→ using their data, generated over 300 customizable responses
- **Carefully and regularly monitor results and making adjustments when necessary**

STUKENT

Evaluation

- **Evaluate whether a campaign has met its goals or not**
  - Coke – social reach over 22 million, increase happiness exposure by 200%
- **Determine how many resources should be spent in the future, if any**

STUKENT

Marketing Analytics Strategy

- **Success of campaigns need to be measured**
  - How much money to spend on them
  - How to improve outcomes
- **Marketing analytics is a continuous function of measuring results of campaigns**

Identify → Analyze → Improve
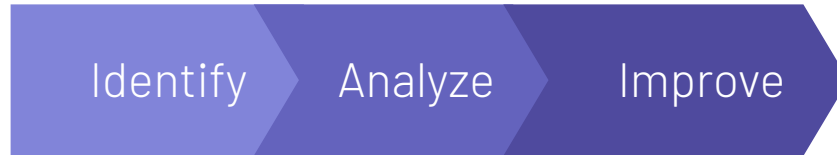
- **Campaign Strategy Steps:**

STUKENT

Or rather, it is a "rinse, lather, repeat" kind of process.

PHASE 3

Take improvement actions

PHASE 1

Identify the metrics

Marketing
Analytics
Strategy

Break until 7:15

PHASE 2

Analyze the metrics

Assignment Project Exam Help

https://powcoder.com

Add WeChat powcoder

19

STUKENT
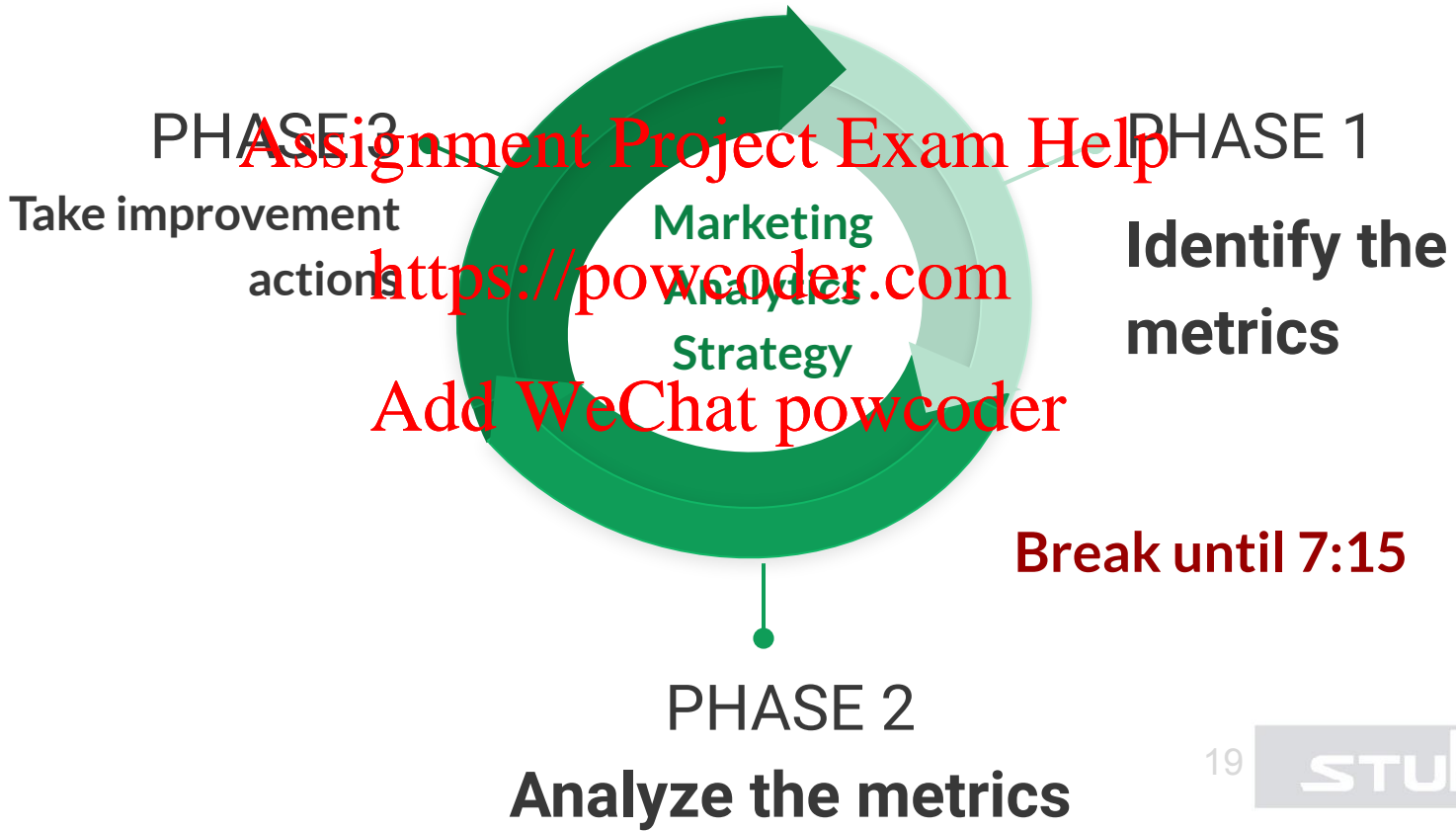
Step 1: Identity Metrics

- **Have a goal in mind**
- **Come up with a question you need the data to answer**
- **Metrics help bring meaning to the data**
  - **Metrics are quantifiable measures used to track the status of a marketing process**
- **Metrics help determine if goals are being achieved**

20

STUKENT

	SITE/BLOG	ASSET	SOCIAL MEDIA	EMAIL	FEEDS
CONSUMPTION	• Page views • Unique visitors • Avg. time on site Google Analytics	• Downloads • Form- completions HubSpot Marketo eloqua	• Link clickthroughs bitly	• Clicks • Open rate Marketo eloqua MailChimp	• Clicks • Views FeedBurner feedblitz
RETENTION	• % Returning • Bounce rate • Number of visits • Pages/Visit Google Analytics	• N/A	• Followers Twitter in f	• Subscribers • Unsubscribers & opt-outs Marketo eloqua MailChimp	• Subscribers FeedBurner feedblitz
SHARING	• Social media link shares • Retweets • Likes SharedCount			• Forwards	• N/A
ENGAGEMENT	• Session duration • Page Depth Google Analytics	• N/A	• Comments & social media chatter Disqus	• N/A	• N/A
MPI	• New leads generated (First, last, & multitouch) • Existing leads touched • Content score ... Marketo eloqua				
SPI	• % and $ value of opportunities influenced/generated • % and $ value of opportunities won ... salesforce fullcircle				
OPERATIONS	Production • Time to live • Content throughput • Content backlog	Cost • Production costs per post • Distribution costs per post • Promotion costs			
ROI	• Return on investment • Pipeline influence per word per writer				

If you use this graphic framework, please cite and link to www.curata.com

curata

Step 2: Analyze the Metrics

- **Companies must implement systems to track the important metrics**
  - Web Analytics
  - Marketing Automation Dashboards
- **Compare current state to benchmarks**
  - Historical Trends
  - Industry Average Performance
- **Most important step is to determine the root cause of why metrics perform the way they do**

Assignment Project Exam Help

https://powcoder.com

Add WeChat powcoder

STUKENT

Example: Analyzing Website Metrics Using Google Analytics
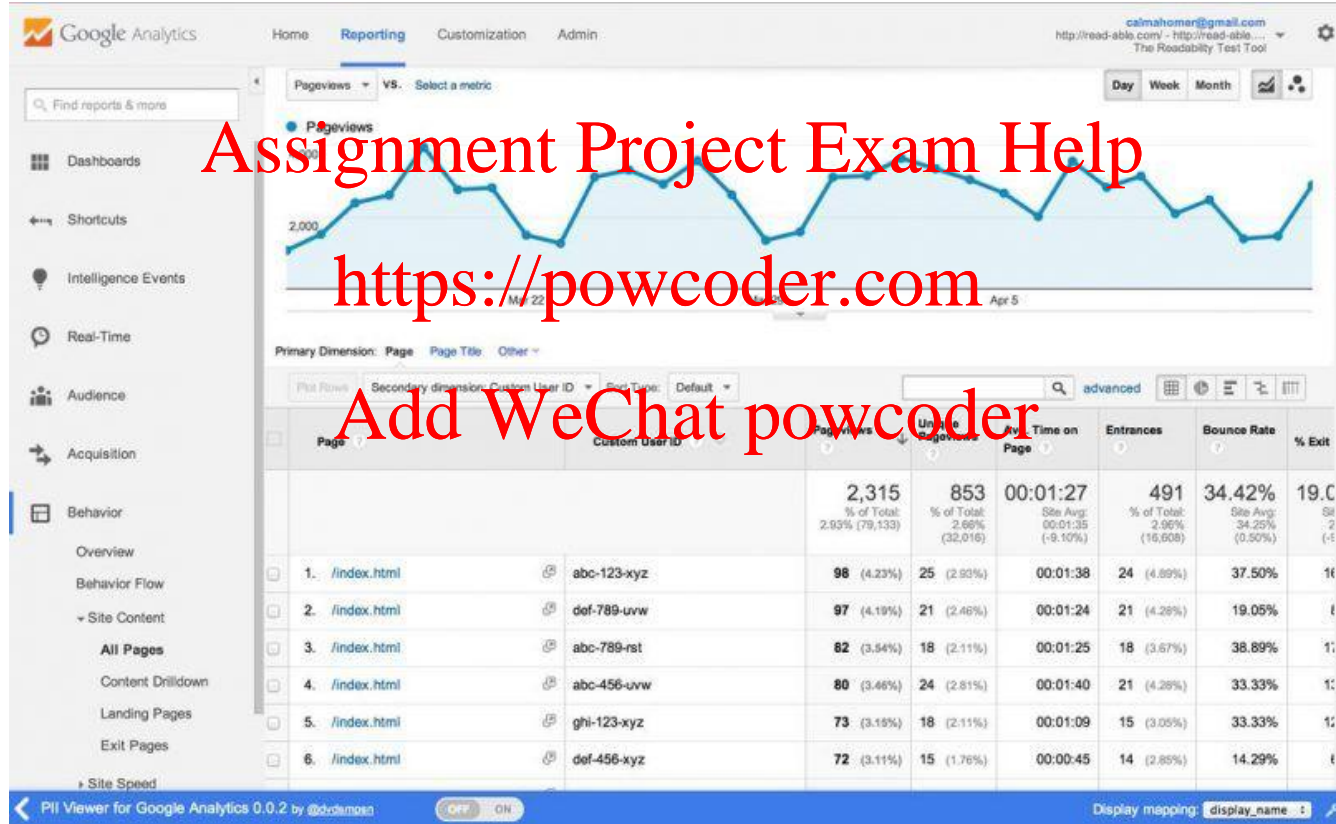
Example: Analyzing Email Marketing Campaign Metrics

Industry	Open Rate	Click Rate	Click-to-Open	Bounce %	UnSub %	Complaint %
Advertising/Marketing	27.86%	9.78%	20.21%	1.19%	0.10%	0.00%
Agriculture	21.58%	7.44%	21.20%	0.88%	0.23%	0.06%
Apparel	16.81%	2.39%	10.11%	0.63%	0.57%	0.06%
Banking	33.01%	4.60%	12.60%	0.01%		0.04%
Construction	25.72%	3.79%	9.64%	1.26%	0.08%	0.01%
Consulting	23.83%	3.55%	10.35%	1.93%	0.28%	0.02%
Education	20.67%	1.89%	7.03%	0.81%	0.18%	0.02%
Engineering					0.22%	0.03%
Entertainment	21.18%	2.88%	8.71%	0.52%	0.24%	0.01%
Finance	23.27%	3.13%	10.52%	3.24%	0.17%	0.03%
Food & Beverage	21.10%	6.89%	22.31%	0.75%	0.18%	0.02%
Government	28.16%	7.16%	14.10%	2.59%	0.20%	0.01%
Healthcare					0.57%	0.06%
Hospitality	21.61%	1.56%	5.70%	0.39%	0.17%	0.01%
Insurance	22.81%	1.35%	4.88%	2.19%	0.17%	0.07%
Manufacturing	24.87%	3.57%	8.97%	0.77%	0.22%	0.02%
Media	14.81%	3.36%	15.41%	0.85%	0.18%	0.04%
Not For Profit	22.50%	3.29%	10.09%	2.23%	0.23%	0.03%
Retail	21.79%	5.45%	17.56%	0.79%	0.20%	0.04%
Technology	23.69%	3.17%	9.28%	2.91%	0.41%	0.05%
Transportation	18.90%	2.20%	8.11%	1.52%	0.25%	0.04%
Utilities	21.10%	2.14%	7.50%	3.48%	0.55%	0.01%
OVERALL AVERAGE	22.17%	3.74%	11.73%	1.04%	0.20%	0.03%

Average Email Metrics by Industry (January 1 - December 31, 2015)

emfluence
Marketing Platform

EXAMPLE: Facebook Video Campaign Metrics

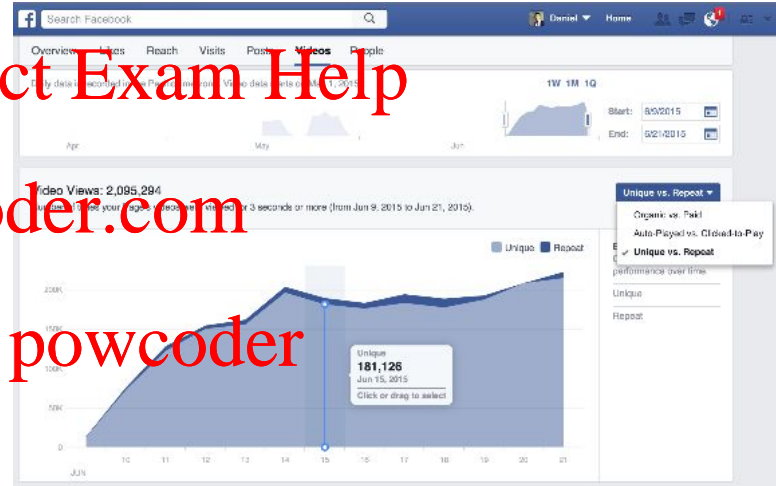- **5 Metrics to track:**
  - Engagement
  - Reach
  - Likes and Follows
  - Video Retention
  - Click Through Rate (CTR)
- **Can be accessed through your business page**

Assignment Project Exam Help

https://powcoder.com

Add WeChat powcoder

Step 3: Take Improvement Actions

- **Most difficult step in the process**
- **Changes aren't always obvious so marketers use analytical and creative skills to develop solutions**
  - A/B testing allows marketers to make isolated changes until the best performing marketing effort can be achieved
- **Invest their resources in areas that need the most improvement**

26

STUKENT

Twitter Marketing Examples

stukent

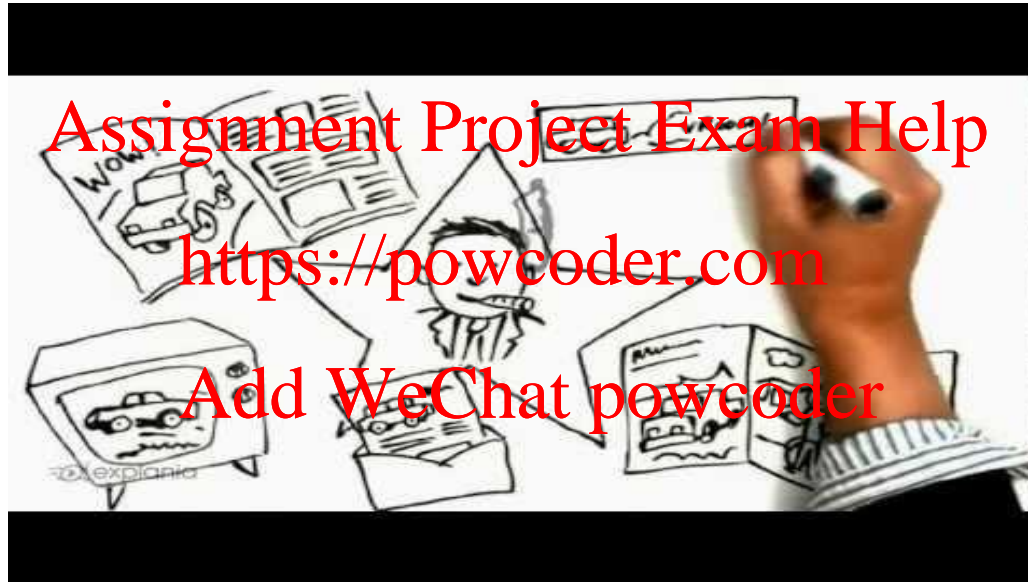# STRATEGIC METRICS

Companies need an overview of the potential revenue available within the market

- **For market entry and exit:**
  - Market size and marketing growth should be measured
- **Return on Marketing Investment (ROI):**
  - ROI = (Marketing Revenue * Contribution Margin) / Marketing Spending

28

Explaining ROMI

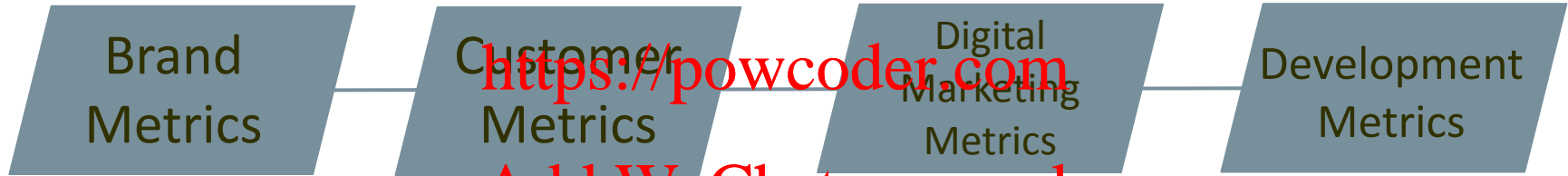https://www.youtube.com/watch?v=1vRx5TYTmYs

STUKENT

Support Metrics

Assignment Project Exam Help

https://powcoder.com

| Brand Metrics | Customer Metrics | Digital Marketing Metrics | Development Metrics |

Add WeChat powcoder

Brand Metrics

Brand Recall	Brand Recognition	Depth	Breadth
ability to retrieve the brand from memory	ability to confirm a prior exposure to a brand	ease with which a brand comes to mind	range of usage scenarios for a brand

FLOPS

It's easy to write a sarcastic Business Insider article making fun of product flops. BUT companies need to experiment. Failure is part of that process. If lack of breadth is impacting a brand? That sounds like a classic "good problem to have"

STUKENT

Support Metrics

- The ability to retrieve a brand from memory.
  - When you think of soda, you think of Coke, Sprite, etc... When you think of fast-food, you think of McDonalds, Taco Bell, etc...
- Brand recall guides our decisions every day.

Brand Recognition

Assignment Project Exam Help

How well can you recognize these logos without the brand name?

https://powcoder.com

Add WeChat powcoder

STUKENT

Assignment Project Exam Help

https://powcoder.com

Add WeChat powcoder

Assignment Project Exam Help

https://powcoder.com

Add WeChat powcoder

Assignment Project Exam Help

https://powcoder.com

Add WeChat powcoder

Assignment Project Exam Help

https://powcoder.com

Add WeChat powcoder

STUKENT

Assignment Project Exam Help

https://powcoder.com

Add WeChat powcoder

STUKENT

Assignment Project Exam Help

https://powcoder.com

Add WeChat powcoder

Assignment Project Exam Help

https://powcoder.com

Add WeChat powcoder

Assignment Project Exam Help

https://powcoder.com

Add WeChat powcoder

Assignment Project Exam Help

https://powcoder.com

Add WeChat powcoder

Customer Metrics

Customer Satisfaction

- renewal rates for services

- likeliness to recommend to friends

- effectiveness of online customer service

- customer ratings on sites such as Yelp or Amazon

STUKENT

Customer Lifetime Value

- Informs companies about how much a customer is worth to them.
  - Especially important for companies like Netflix, where they want customers to continue to subscribe to its services.
- These metrics focus on the LONG TERM value a single customer brings to the company.

45

Customer Lifetime Value

Informs companies about how much a customer is worth to them

$$\text{Customer Lifetime Value} = (\text{margin}) * \frac{(\text{retention rate})}{(1 + \text{discount rate}) - (\text{retention rate})}$$

Margin = customer revenue – cost it takes to service the customer

Retention rate = percentage of customers who remain loyal over time

Discount rate = cost of capital for the organization

Retention rate = percentage of customers who remain loyal over time

NETFLIX

- Lifetime Value calculations drive pricing and marketing decisions

- Average subscribers

  - $150 to acquire and maintain each customer
  - Year 1: 12 months * 10.99/month = **$131.88**

- Solidifies budget for new movies, shows, and marketing expenses

- Netflix has truly mastered Customer Lifetime Value *"down to the penny"*

- Track each individual subscriber's tastes and preferences

- When a customer is about to leave, Netflix:

  - Knows they watch less
  - Uses profile information to maximize Retention Rates by finding ideal shows and movies

NETFLIX

The average Netflix customer subscribes for 25 months at $10.99 per month.

- Calculate the Average Lifetime Value of a subscriber and subtract 20% for overhead costs.

- As a marketing team, decide how you would use this revenue to expand and maintain Netflix's subscriber base.

  - How much (in dollars) goes toward advertising?

  - How much goes toward adding new content?

  - Which metrics would you track to determine if your approach was successful?

NETFLIX

RETENTION

Assignment Project Exam Help

https://powcoder.com

"Netflix has now captured 52% of US broadband households, and in the last year, only 9% of its subscriber base has canceled."

Add WeChat powcoder

Current and Former OTT Service Subscribers
U.S. Broadband Households

- ■ Current Subscribers
- ■ Cancelled in past 12 months

© Parks Associates
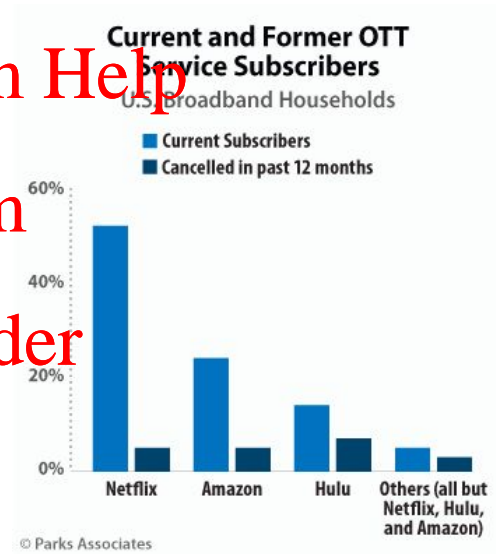
Customer Profit

- The profit a company makes off a customer or customer group over a period of time
- Seeks to acknowledge customer value

Customer Profit = customer revenue - customer costs

EXAMPLE: Sephora's Beauty Insider Program

Assignment Project Exam Help

- Customer loyalty programs are often used to increase customer profits.
  https://powcoder.com
  - Point-based program - customers get points for each dollar spent and can redeem them for beauty supply products at checkout
  Add WeChat powcoder

STUKENT

Digital Marketing Metrics

- *Total Conversions*: number of people who have taken a desired marketing outcome, as defined by the marketing team. Examples include completing a checkout on an ecommerce site; filling out a lead form; subscribing for a service; or signing up for a newsletter.

- *Impressions*: the number of time marketing content has been displayed, including the same person multiple times and regardless whether there is any response to the marketing content.

- *Total Reach*: the number of people who received impressions. Or the total number of followers, retweets or friends.

STUKENT

Digital Marketing Metrics

- *Conversion Rate*: the total conversions divided by the total reach.

- *Micro Conversion Rate*: the conversion rate at the campaign or platform level (e.g., the conversion rate for a particular marketing video delivered to newsite apps on a mobile phone).

- *Conversion Funnel Rates*: the portion of customers who make it through to the next level of each step in the journal from impression to conversion (e.g., from impression to click-through; then from click-through to placing an item in the shopping cart; then from the shopping cart to checking out).

53

STUKENT

Digital Marketing Metrics

- *Lead to Close Ratio*: total number of sales leads by the total number of sales (important for sales analytics)

- *Total Visits*: Total visits to a webpage (non-unique, including unlimited visits by the same person)

- *Unique Visitors*: Total unique visitors to a webpage (monitored by IP address)

- *New Sessions*: The total number of new site versus recurring visitors.

54

STUKENT

Digital Marketing Metrics

- *Site Time*: the amount of time a customer spends on a site (e.g., important for media providers).

- *Direct Traffic*: number of people who typed in the URL to get to the website.

- *Referrals*: number of people who clicked a link from another website to get to the website.

- *Organic traffic*: number of people who reached the website by perform a search from sites like Google or Bing.

- *Social traffic*: number of people who found the website through social media.

Digital Marketing Metrics

- *Bounce Rate:* Percentage of people who leave the webpage after viewing only one page

- *Click Through Rate (CTR):* Ratio of people who click on a link compared to the total number of people who saw the link.

- *Customer Retention Rate (CRR)*: percentage of customers who return to buy again.

- *Customer Acquisition Cost (CAC)*: Total marketing costs over a period of time/ Total amount of new customers in that same time period.

- *Open Rate*: the number of people who open an email that has been sent to them dividing by the total number of people to whom the email was sent.

STUKENT

Digital Marketing Metrics

TSL Marketing — plan·develop·manage — Digital Marketing Metrics Cheatsheet

SEO
- 44% — CTR, 1st Result Organic Search
- 20% — CTR, 2nd Result Organic Search
- 8% — CTR, 3rd Result Organic Search
- 7-9% — Organic Search to Lead Conversion
- # Backlinks — Largest Non-Social Driver of Rank
- 22-27% — Form Submission Organic Search
- 20% — Program Budget Spent on Content Marketing

SEM
- 6-7% — CTR, Google Adwords
- 0.1-.2% — CTR, Google Display Network
- 0.9-1% — CTR, Mobile Banner Ads
- $4-13 — CPC, Paid Search
- 2-4% — Paid Search to Lead Conversion
- 34% — Program Budget Spent on Digital Marketing

EMAIL MARKETING
- 24% — Gross Open Rate Prospects List
- 5% — Unique Open Rate Prospect List
- 15-18% — Unique Open Rate Customer List
- 65%vs25% — 1st vs 3rd Email Open Rate, Drip Campaign
- 0.9% — Bounce Rate Prospects List
- 2% — CTR, Prospects List
- 20-22% — CTR, Customer List
- 8% — CTR, Drip Campaigns
- 13% — CTOR Rate Prospects List
- 21% — Desktop CTOR Rate Prospects List
- 7% — Mobile CTOR Rate Prospects List
- 2-3 — Touches/Month Drip Campaign
- 18-23% — Form Submits Paid Search
- 9% — Form Submits Email
- 7-9% — Name to MQL Conversion
- 5% — Form Submits Social Media
- 7-10% — Program Budget Spent on New Lead Gen Tactics
- 13% — DMP Spent on Website
- 4% — DMP Spent on SEO
- 6% — DMP Spent on Social Marketing

SOCIAL
- 0.21% — Facebook CTR
- .9-1.3% — Twitter B2B Post Engagement Rate
- .025-.04% — LinkedIn CTR
- $5 — Facebook CPM
- $0.35-1 — B2B Promoted Tweets CPE
- $4.89 — Promoted Tweet Cost/Follower
- $4 — FaceBook CPC
- 0.02% — FaceBook Like Rate
- 5% — Form Submits Social Media
- 0.7% — Facebook Lead Conversion
- 2.2% — Twitter Lead Conversion
- 0.8% — LinkedIn Lead Conversion
- 14% — DMP Spent on Marketing Automation
- 13% — DMP Spent on Email Marketing
- 20% — DMP Spent on Search Ads

CONTENT
- 34% — Companies Using Content Syndication
- 40-50% — Webinar Attendance as a % of Registrants
- 20-30% — Webinar Conversion Rate
- 10-15% — White Paper Conversion Rate
- 44% — Firms Partially Outsourcing Content Creation
- 22% — DMP Spent on Display Ads

WEBSITE
- 41% — Traffic from Organic Search
- 16% — Traffic from Paid Search & Referral
- 50% — Drop-Off Rate
- 3-4 — Page Views per Visit
- 2-3 — Minutes Spent on Website per Visit
- 2-5% — Website Visit to Responder
- 8% — Other DMP Spent (SMS, Digital Events, etc.)

57

Development Metrics

Measures a company's ability to leverage competitive advantage and product or service development.

Divide each development project into:

1. Low cost

2. Customization

3. Quality-oriented development

4. Responsiveness

5. Product innovation

58

STUKENT

Low Cost Metrics

Measure the ability to deliver goods
and services at a low cost

Assignment Project Exam Help

https://powcoder.com

Add WeChat powcoder

STUKENT

Customization Metrics

- **Measure the ability to tailor products and services to customers**

  - Can include modular design, configuration systems, flexible manufacturing, and JIT inventor

  - Dell allows customers to configure and customize their PC to their liking, using online configuration tools.

60

Quality Metrics

Ensure that companies produce high quality products and services

- Includes certifications, training, employee involvement, etc.
  - Hospitals often conduct ongoing training for surgical staff to ensure that they are constantly delivering top-quality healthcare.
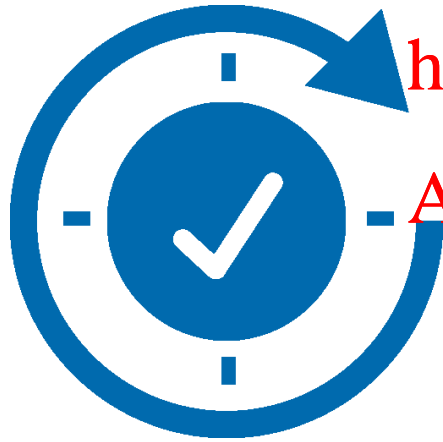
STUKENT

Responsiveness Metrics

Measure whether companies are attentive to customer needs

- Include measures of development speed, attentiveness to needs, and market feedback

- Many companies release new updates in the App Store to better the users experience.

STUKENT

Innovation Metrics

Measure a company's ability to innovate and develop a mix of new offerings

- Measure levels of breakthrough products, next generation products, major enhancements, minor enhancements and corrections

Assignment Project Exam Help

https://powcoder.com

Add WeChat powcoder

STUKENT
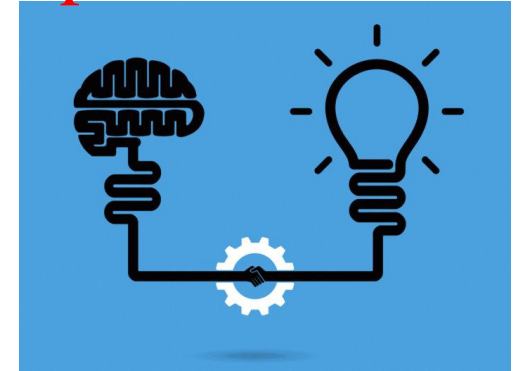
Walmart

Walmart collects metrics about consumers, analyzes that information in complex ways, and use the results of that analysis to track consumers on and offline while shaping the company's marketing efforts

- Has exhaustive data on at least 145 million Americans – more than 60% of U.S. Adults

- Walmart shares customer's data gathered online with more than 50 third parties

- Ingests just about every clickable action on Walmart.com: what individuals buy online and in stores, trends on Twitter, local weather deviations, and other local external events

  - Intelligently tease out meaningful patterns so millions of customers have a shopping experience that is individually personalized

- Maintains the ability to track customer movement in stores while connected to in-store Wi-Fi

  - *We want you to know that, when you access or use [wireless networks and associated services], Walmart will receive information that may identify you or*
    the device you are using. That information may include MAC address, IP address, and unique device identifier such as a name or number assigned to the device. If you were required to login in order to access or use the Service, then registration information we obtain from you may include your name, phone number and email address. We also will receive the real-time location of your device while it is accessing the Service.

Walmart ☀

- The "personalized shopping experience" doesn't sound like a bad thing. Do you think it is a good one?

- Many companies are able to retrieve and predict personal customer information and do with it as they please. Does this make you uncomfortable? Why or why not?

- What other ways do you believe companies are able to get personal information on customers?
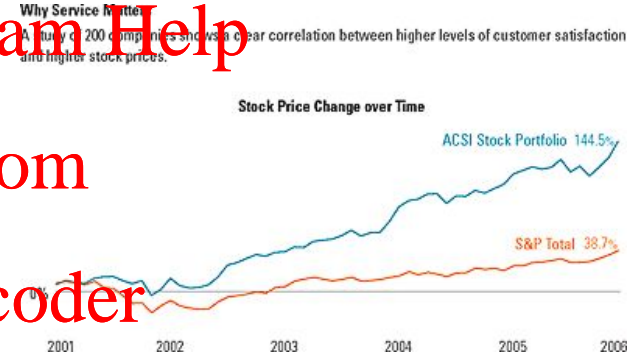
University of Michigan

- Quality Metrics: Customer Satisfaction

- American Customer Satisfaction Index (ACSI)

- More important for services than durable goods

- Short-term earnings or long-term satisfaction

Why Service Matters
A study of 200 companies shows a clear correlation between higher levels of customer satisfaction and higher stock prices.

Stock Price Change over Time

ACSI Stock Portfolio 144.5%

S&P Total 38.7%

2001 2002 2003 2004 2005 2006

STUKENT

University of Michigan

- What can companies do to increase customer satisfaction?
  - Think of companies that you are loyal to - why do you like them?

- What types of businesses do you believe would not be as concerned about long-term customer satisfaction?

STUKENT

Forecasting

Qualitative Forecasting: Overview

These are forecasts that rely on judgement, experience, and opinions

In some cases, it may be superior to something "data-driven" (if the data is garbage, then remember GIGO: "Garbage In, Garbage Out."

Steve Jobs is a well-known example of a business leader who innovated without necessarily relying on some else's metrics, data, polling, etc.

Qualitative Forecasting: Pros

This method may be particularly useful/helpful/appropriate when sufficient numerical data is not available

Some experts may have developed intuitive judgment over years of studying a particular field, or being involved in a particular business

Qualitative Forecasting: Cons

Subjective judgements are very prone to biases:

Overconfidence bias

"I know I'm right… no one else gets this."

Anchoring bias

"What was last year's number?"

Groupthink

"I don't want to rock the boat here…"
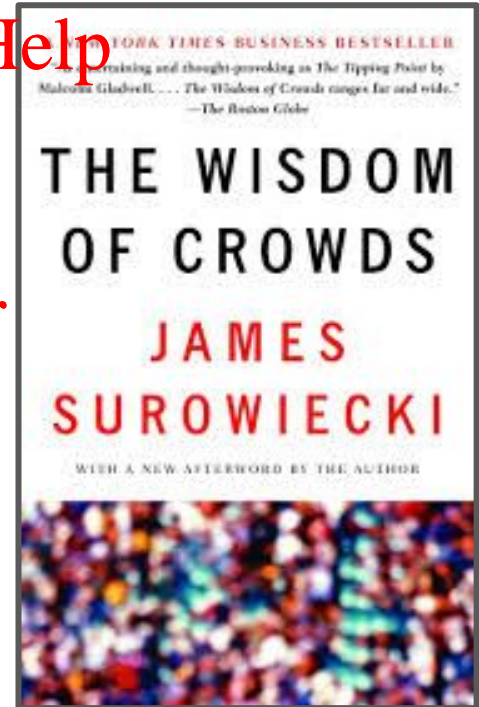
Wisdom of Crowds: Collective Forecasts

"Collective decisions are most likely to be good ones when they're made by people with diverse opinions reaching independent conclusions, relying primarily on their private information."

Four conditions for wise crowds:

- Diversity of opinion
- Independence
- Decentralization
- Aggregation

NEW YORK TIMES BUSINESS BESTSELLER

"As entertaining and thought-provoking as *The Tipping Point* by Malcolm Gladwell. . . . *The Wisdom of Crowds* ranges far and wide."
—*The Boston Globe*

THE WISDOM OF CROWDS

JAMES SUROWIECKI

WITH A NEW AFTERWORD BY THE AUTHOR

Assignment Project Exam Help

https://powcoder.com

Add WeChat powcoder

Okay, let's revisit this jar question!

PageRank and Collective Wisdom

Page Rank

Time Series Data: Overview

Time series data involves measurements that contain both numeric values and a meaningful timestamp associated with each of those values.

That timestamp might be a date, a week, a month, a year, or any other repeating period. By including information about not only *what* happened, but also about *when* it happened, time series data lets us better understand a particular phenomenon that we want to study across a period, such as stock price movement, weather patterns, or demographic trends.

Time Series Data

Time Stamps -- particular moments in time

Time intervals / periods -- a length of time between a specific beginning and end point.

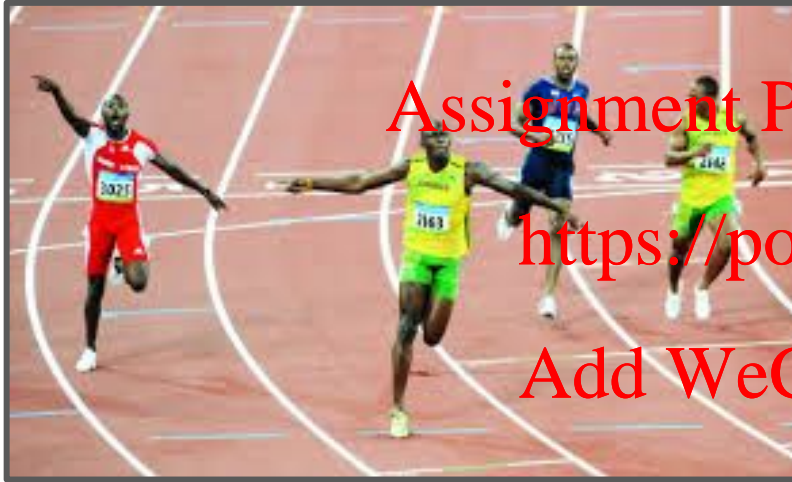Time delta / duration -- an exact *length* of time

AD654 Takeaways: Delta just comes from a Greek symbol meaning "change." It might seem like the second two definitions are redundant, but the distinction is whether the specific beginning and endpoints matter. See the next slide for an example.

Duration vs. Interval

When we talk about the 100m dash, we care mainly about time duration.

When we measure stock market performance, we care about intervals -- not just duration. (think about a comparison to something like the S&P 500)

Time Series Components

Level: The average value of the time series.

Trend: The direction of movement in the data across time. A time series can show an uptrend, a downtrend, or no trend.

Seasonality: A pattern of activity in a time series that is repeated at regular intervals.

Cyclicality: A pattern of activity in a time series that involves a repeating pattern that occurs across irregular intervals.

Noise: The random variation in a time series that is caused by either measurement error or irregular movement in the value being measured.

Simple Forecasting Methods: An Overview

Naive Method (Last Observation Carried Forward)

The naive method for forecasting is sometimes referred to as LOCF, or Last Observation Carried Forward.

While the naive method might sound too simplistic to be of much use, there are some instances in which it is quite handy. For example, look at weather forecasting. Suppose you are trying to predict tomorrow's weather. (Let's also assume that you're an amateur weather forecaster who lacks any sophisticated equipment). To estimate the high temperature for tomorrow, you could simply use today's high temperature.

Let's take a look at how this would have done for any particular 7-day period.

LOBSTER LAND

	Actual	Forecast	AD (Absolute Deviation)	Error (Observed - Forecast)
Day 1				
Day 2				
Day 3				
Day 4				
Day 5				
Day 6				
Day 7				

Naive Approach / LOCF: Summary

Useful if you need to make a quick forecast/prediction in the absence of any other data/info

Can be applied seasonally

    In other words, it doesn't have to *just* be the last thing measured. For example, Lobster Land could use this to predict July 2020 sales, using July 2019 sales

Not very useful in a practical way. Think about it—if you were planning a trip, could you use this for weather data?

Particularly ineffective for anything that tends to fluctuate up and down over periods, such as stocks.

Trend

Forecast value for the next period equals the last observed value in the series, plus or minus the difference between the last *two* observed values in the series.*

* Not the only way this can be done.

Our Mission

Together, let's make some stock market predictions for tomorrow, using the trend method.

What I need: Volunteers to give me the names of a few companies.

Trend

Forecast value for the next period equals the last observed value in the series, plus or minus the difference between the last *two* observed values in the series.*

09MAR	$30
10MAR	$35
PREDICTED 11MAR	**$40**

* Not the only way this can be done.

Mean Method

The mean method is a simple, but sometimes effective, approach to forecasting -- as its name suggests, it involves finding the average of all previous observations and simply using that value to predict the value for the next observation.

# Mean Method: Is it Simple? Or Complex?

This approach is straightforward, and completely free of fancy notation, but it actually captures quite a bit of underlying information. Think about using it to predict the number of runs a baseball team will score in its next game -- what are some of the factors that influence this number? Good hitters would help to push that number upwards. If positive intangible factors like "good team chemistry" are present, then those will push the number upwards, too. Injuries to key players might push that number downward.

But how would we capture all the seemingly myriad factors that we would need to generate the prediction? The good news here is that we don't have to overthink it! Since all of those factors in the paragraph above are already "baked in" to the game statistics from earlier in the season, we could use the mean method to predict something like the number of points a team will score in their next game.
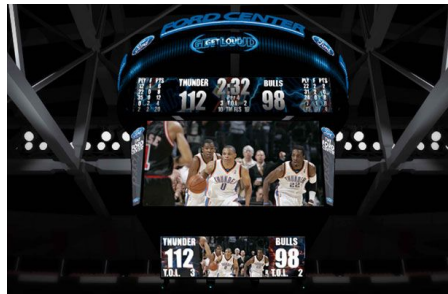
Simple Moving Averages

When an analyst wishes to use the mean method for forecasting, but with only the most recent observations used as inputs, she may decide to use a moving average, which is sometimes referred to as a simple moving average.

When using a moving average for prediction, the analyst must decide on a k value (with k representing the number of periods) to use. The k value is also sometimes referred to as the window. Using a smaller window means that the prediction will be based on newer data, whereas a larger window means that older data will be included.   A larger window also generally means that outliers will have less influence on the forecasted observations.   Larger windows tend to generate smoother lines when the time series data is visualized.

In stock market analysis, a commonly-used window is 200 days. Viewers of CNBC will often hear the term "trailing moving average." Such an average uses the most recent data point, and then moves backwards to a specified point to capture the data that will be used in the forecast.
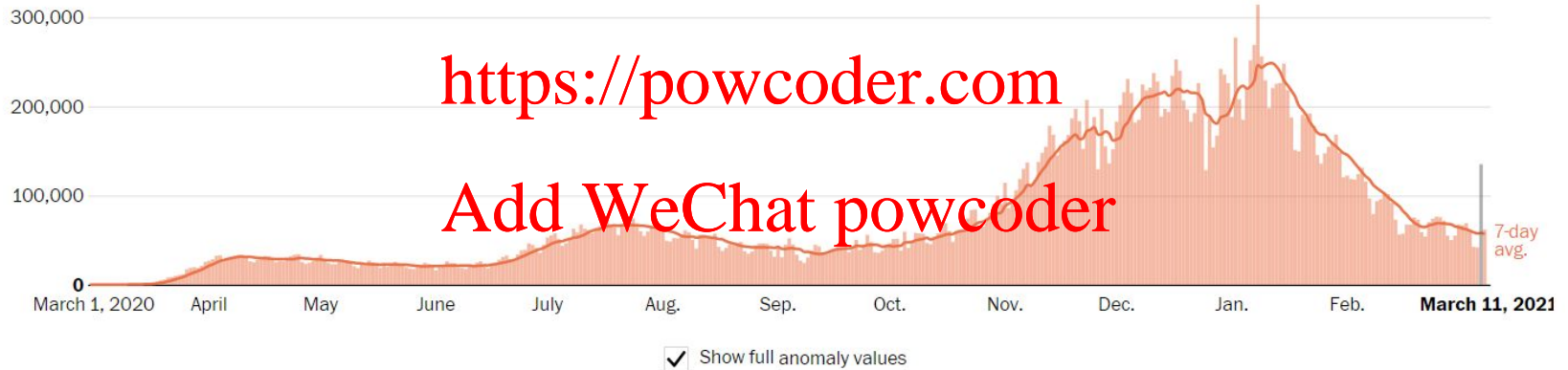
Exponentially-Weighted Moving Averages

$$F_{t+1} = F_t + (\alpha)E_t$$

Single Exponential Smoothing (SES), also sometimes known as Simple Exponential Smoothing, is used for time series forecasting when the data shows **neither trend nor seasonality**. The advantage of SES is that it enables the modeler to use a constant, usually referred to as alpha, in order to place more weight on recent forecasts when making a prediction. This weighting adds a dynamic element that simple moving averages lack, as a simple moving average uses a constant window size and equally weights each observation inside that window.

The equation shown above this paragraph is how we will represent our single exponential smoothing forecast for a given period. In this equation F_{t+1} is the forecasted value for the next period. F_t is the forecasted value for the current period. Alpha is the adjusting constant, and E_t represents the error, which is found by taking the observed value (i.e. the actual value) for this period and subtracting the predicted value.

Where Does Alpha Come From?

The larger the alpha value goes, the more weight will be placed on recent observations. Smaller alpha values will show the longer-term tendency of the time series.

To see this, let's think about the extremes (alpha can range from 0 to 1). If alpha is zero, we're just really using the naive approach -- we're predicting the next observation with the most recent one that we have. If alpha is is 1, we are adjusting as much as possible based on the error that we saw with the most recent observation.

How might we do this the real world? We could experiment with different alpha values, see how we do, and then adjust accordingly.

Our Mission: Simple Exponential Smoothing Example

Year	1	2	3	4	5
Revenue	65,000	80,000	90,000	70,000	98,000
Forecasted Revenue	75,000	72,000	74,400	79,080	76356
SES Forecast Error	-10,000	8,000	15,600	-9,080	

$$F_{t+1} = F_t + (\alpha)E_t \qquad \text{ALPHA} = 0.3$$

Python Scripts
Our Mission:

Lecture7_Dates_Times_TimeSeries

Turning Lobster Land into a Time Series

Operation ROLLING LOBSTER