(A) **Preparation for Week 4**

Managerial Decision-Making Process

Step 1: Recognize the Need for a Decision

Step 2: Generate Alternatives

Step 3: Assess Alternatives

Step 4: Choose Among Alternatives

Step 5: Implement the Chosen Alternative

Step 6: Learn from Feedback

Business Analytics Process

Source of Data

Descriptive Business Analytics

Predictive Business Analytics

Prescriptive Business Analytics

Measurable Increase in Business Value and Performance

Selection & Implementation of Analytics Methods and Models

Statistical Forecasting (Time Series with Unknown Causals & Regression)

Define the Business Problem & the Analytics Problem

Select a Method & Develop a Model

Acquire Input Data

Develop a Solution

Test and Validate the Solution

Change?

Analyze the Results

Implement the Results

Change?

yes

no

yes

no

Moving Averages

Single Exponential Smoothing

Double Exponential Smoothing

Triple Exponential Smoothing

Multiple Regression

Evaluation of the Results

Recommendations:
➔ Business Analytics Process (overall & next steps)
➔ Managerial Decision-Making Process (overall & next steps)

Figure 7.1:   Connecting Managerial Decision Making Process with Business Analytics Process and the Implementation of Selected Business Analytics Methods & Models: **Predictive Analytics**

The management information system collects last week data from all sales

— Data →

The management information system collects price and promotion data from the marketing system

— Data →

Sales forecast generated for the next 24 weeks

Forecasting group adjusts its forecast based on its knowledge of the markets by regions

Down stream partners adjust their forecast based on their knowledge of the local market

Supply chain system translate forecasts into production, shipments, purchases, and inventory

Next 8 weeks forecast

Next 8 weeks forecast

24 weeks forecast

Weeks 9-24 forecast

MONDAY

TUESDAY MORNING

TUESDAY AFTERNOON

WEDNESDAY

THURSDAY

Respondents Using Predictive Analytics Application

Application	Percentage
CROSS SELL/UPSELL	47%
CAMPAIGN MANAGEMENT	46%
CUSTOMER ACQUISITION	41%
BUDGETING AND FORECASTING	41%
ATTRITION/CHURN/RETENTION	40%
FRAUD DETECTION	32%
PROMOTIONS	31%
PRICING	30%
DEMAND PLANNING	30%
CUSTOMER SERVICE	26%
QUALITY IMPROVEMENT	25%
MARKET RESEARCH	18%
SUPPLY CHAIN	17%
OTHER	12%

Target the lead who is most likely to convert and will be the highest value. Algorithms can use explicit and implicit data from CRM.

Metropolitan College

Problem: Customer acquisition costs are high
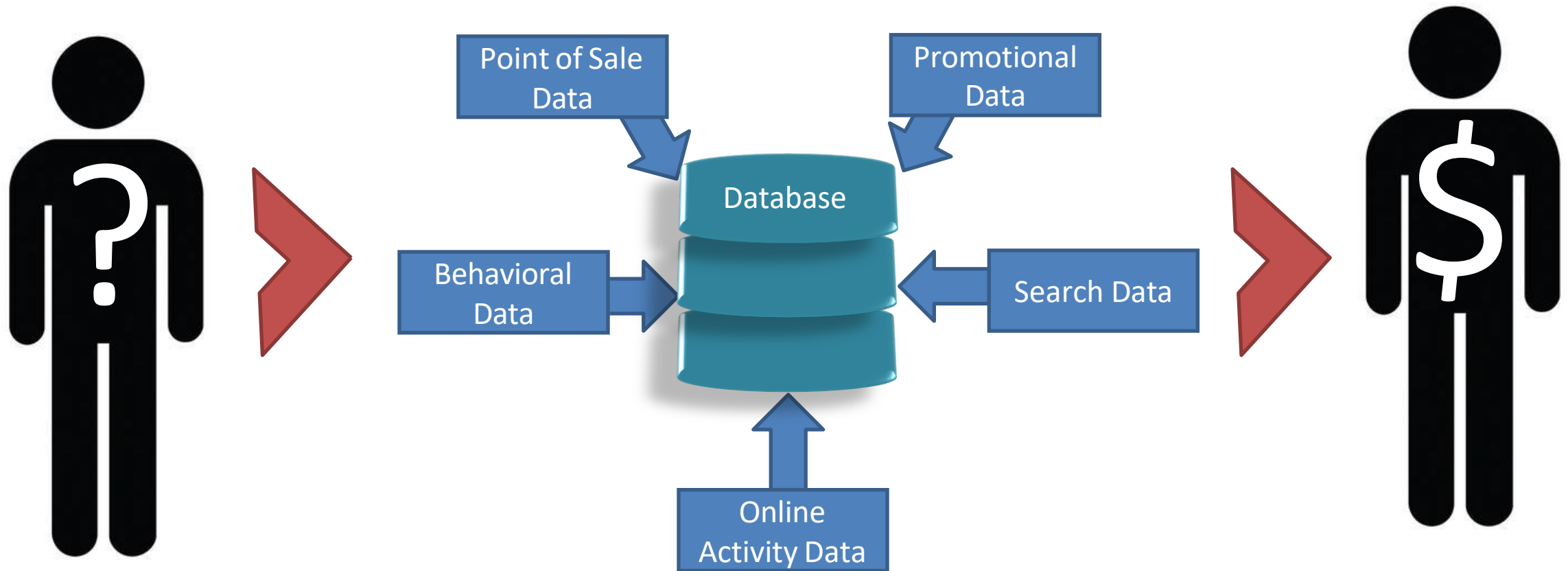
We don't know customer well until data is collected

Attrition/Churn/Retention

Source: https://klaviyo.com
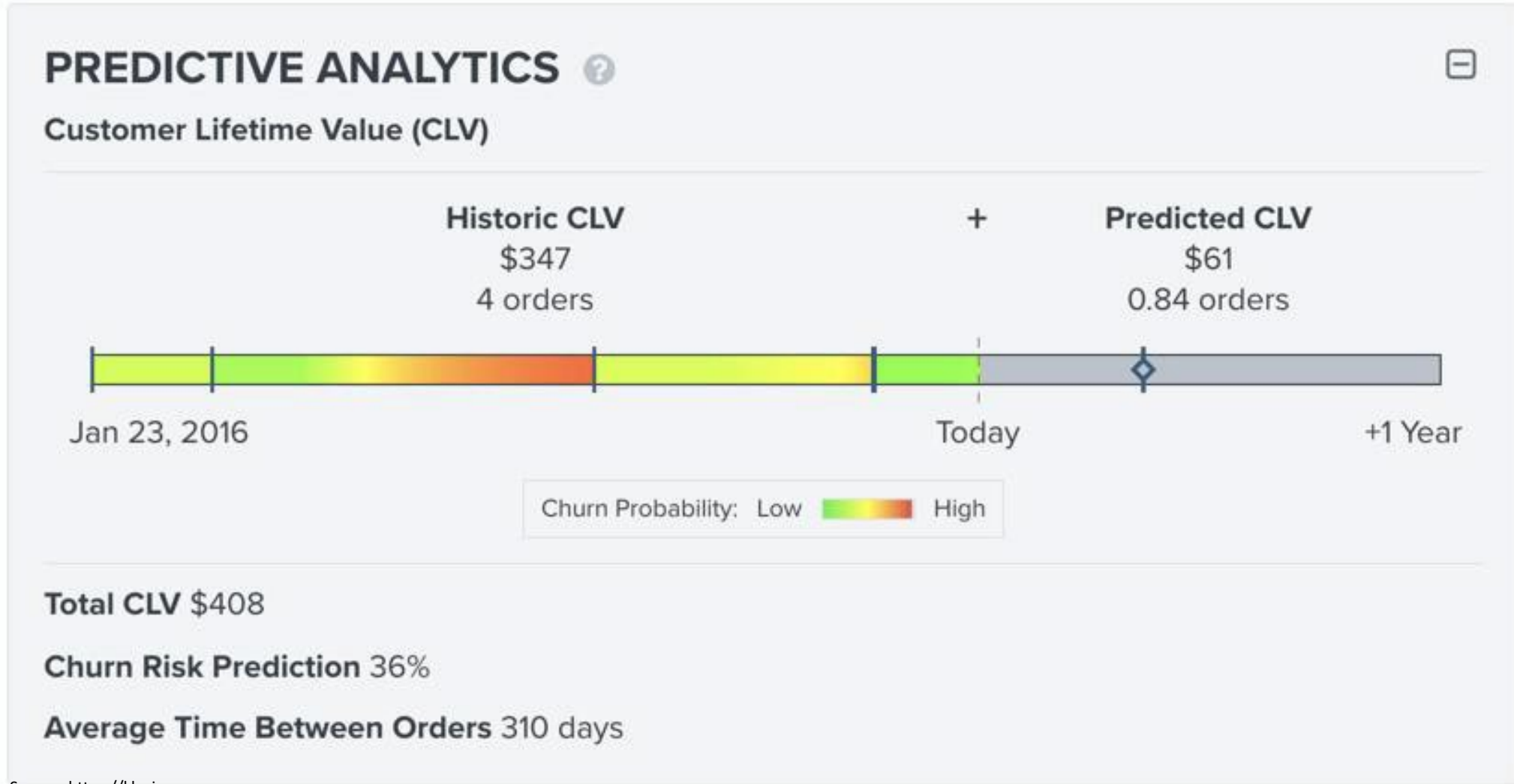
Evolution of Churn and Retention

Sophistication Level

Savable value targeting

Standard Signal Same for all. (Renewal time)

Value at risk targeting

Likelihood * Value
Who will respond and who will leave faster?

We want all customers

Churn Risk Targeting

Retention - untargeted

Is this a valuable customer we are spending to keep?
(Churn Risk * Value)
Bad vs. Good Customer

Looking at variables that increase churn risk

Acquire All

Past

Future

Application		Attribute To Predict
Consumer Retention	→	Churn
Direct Response Marketing	→	Response
Recommendation System	→	Preferences
Behavioral Marketing	→	Clickable Ads
Email Targeting	→	CTR / Action
Credit Risk Scores	→	Debt Risk
Fundraisers	→	Capital
Insurance Pricing	→	Insurance Risk
Portfolio Management	→	Asset Allocation

Source: https://commons.wikimedia.org/

Simulated paths of the value of an asset using Monte Carlo

Cash Flow

Statistics for Cash Flow

Min..1% / 99%..Max	1%..5% / 95%..99%	5%..15% / 85%..95%
15%..25% / 75%..85%	25%..35% / 65%..75%	35%..45% / 55%..65%
45%..55%	50%	

http://goldsim.com

Forecast: Ending Value

100,000 Trials   Frequency Chart   1,652 Outliers

Mean = $2,007,355

Certainty is 55.16% from -Infinity to $2,007,236
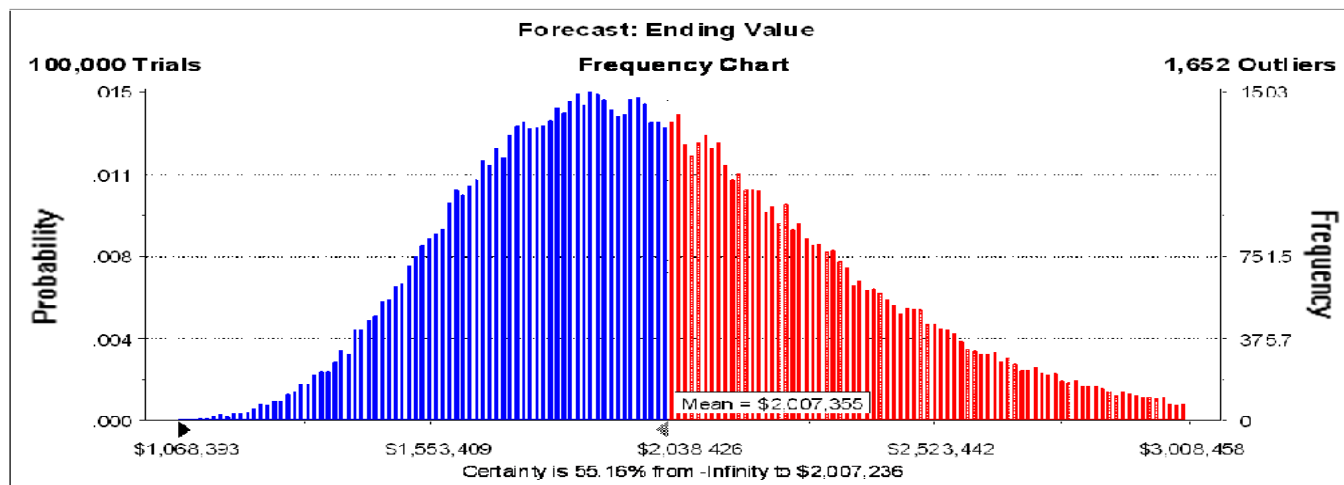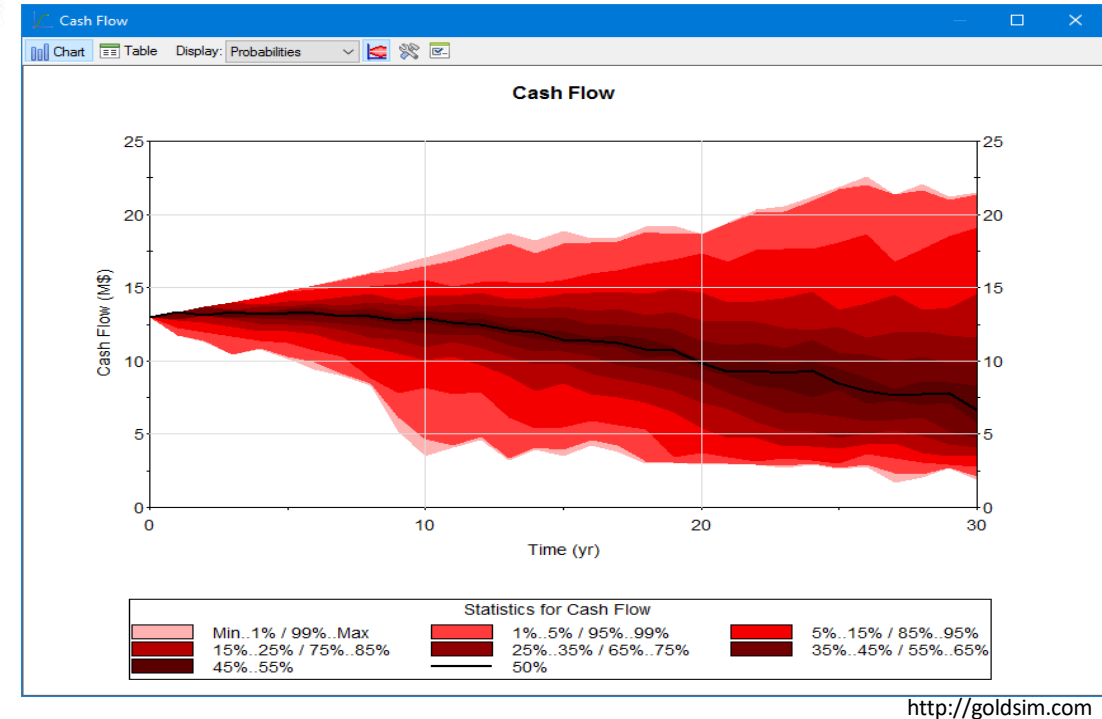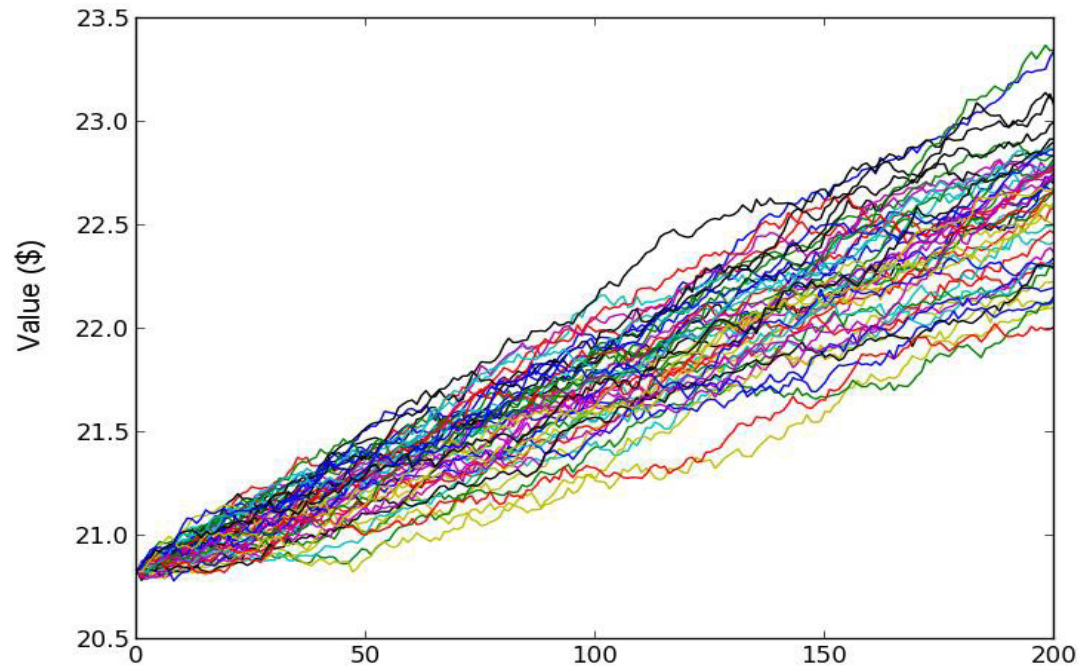
Source: Financialplanningbodyofknowledge.com

Source: http://simafore.com

Source: http://stackexchange.com

Source: http://medium.com

Source: http://Sflscientific.com

Preparation for Week 4: Predictive Analytics Applications – Market Analysis

Source: http://www.gminsights.com
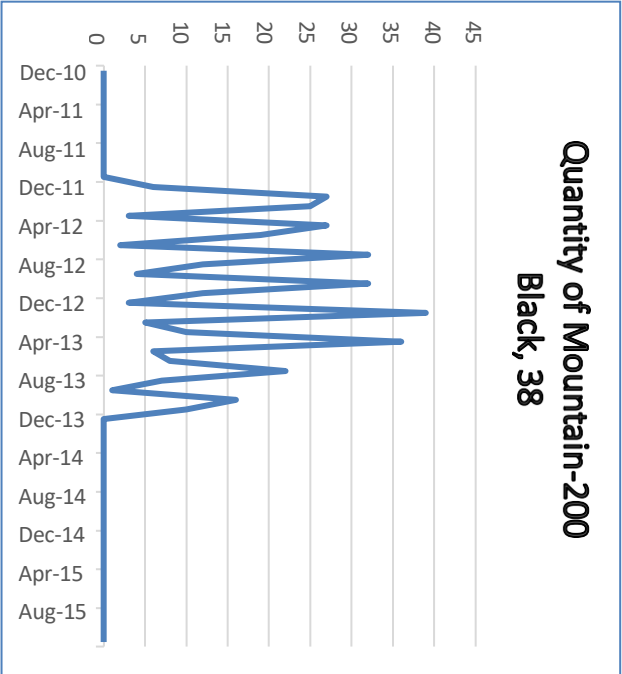

Source: http://chironhealth.com
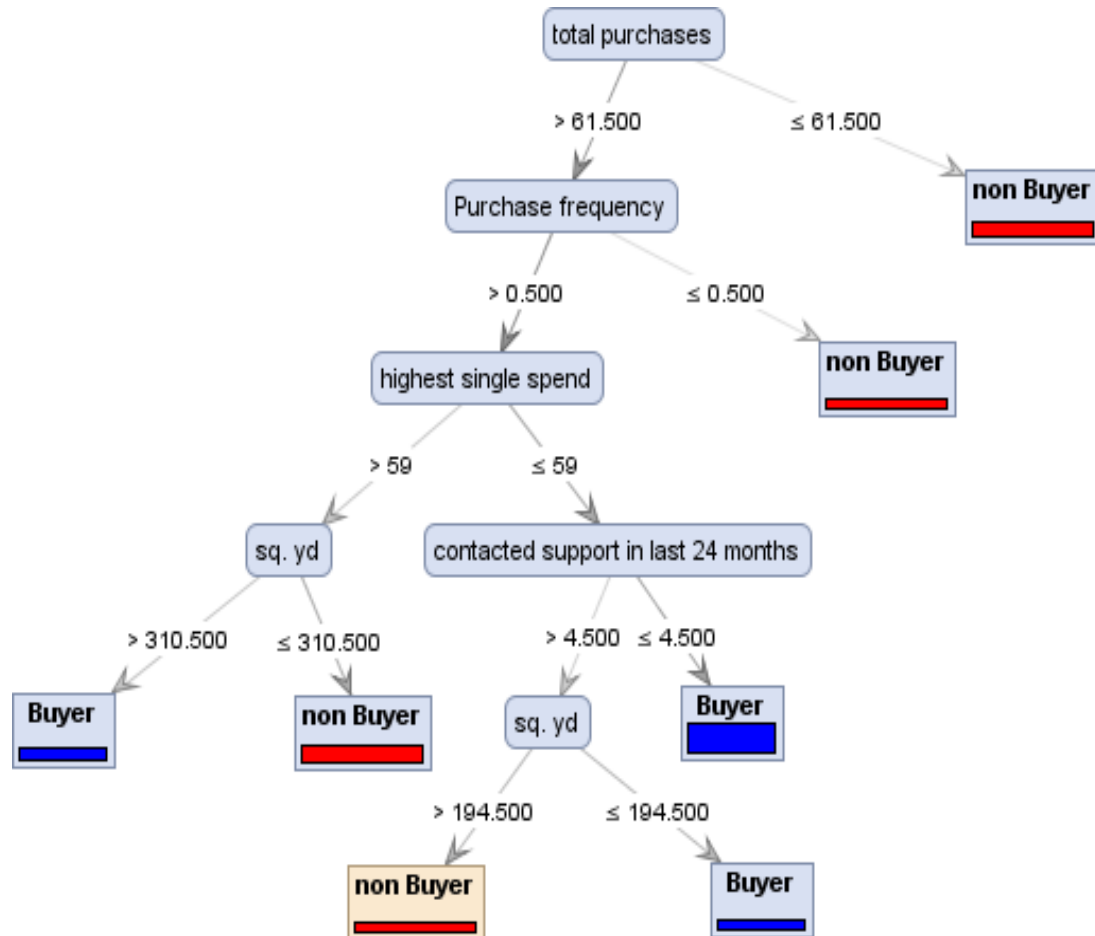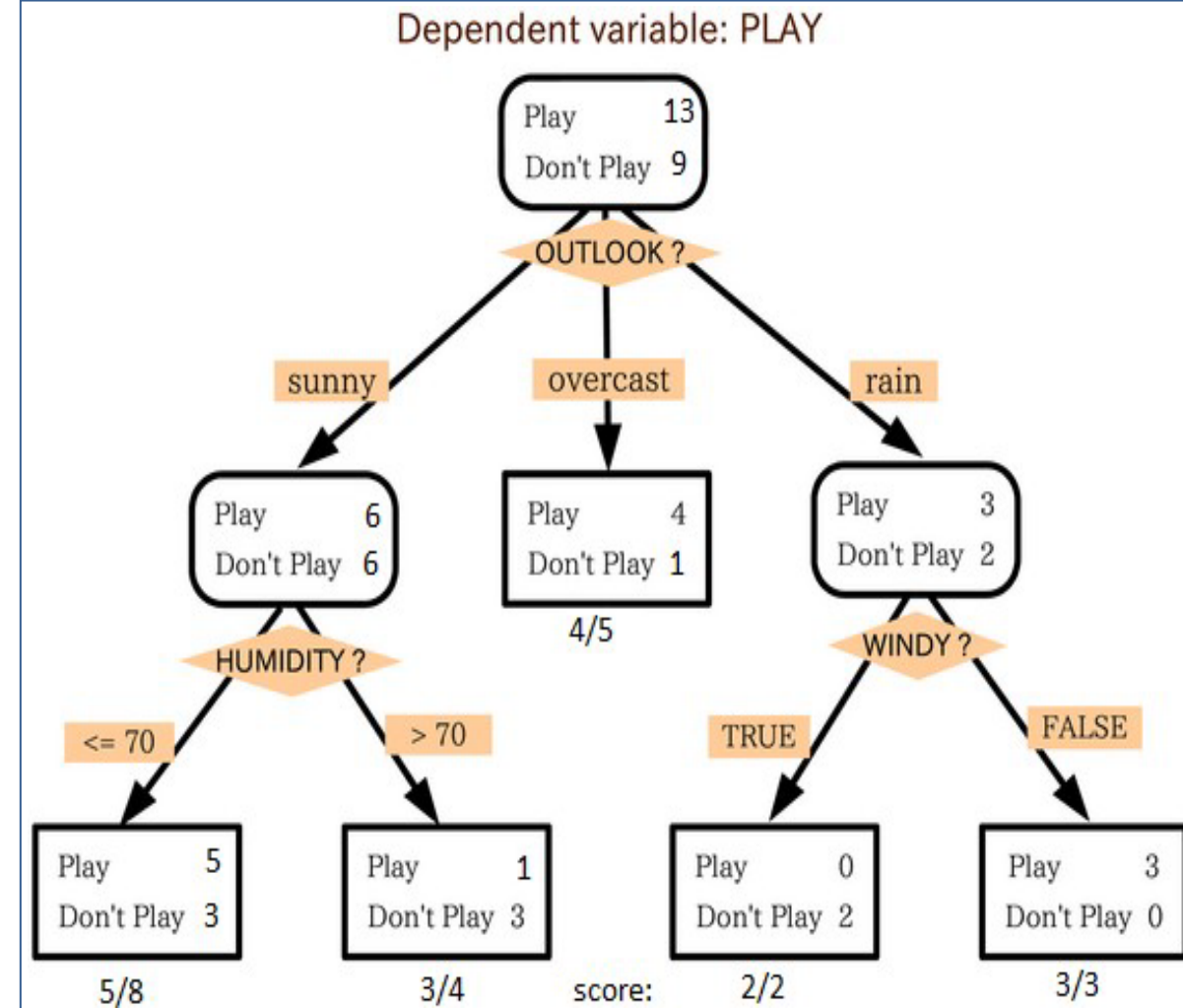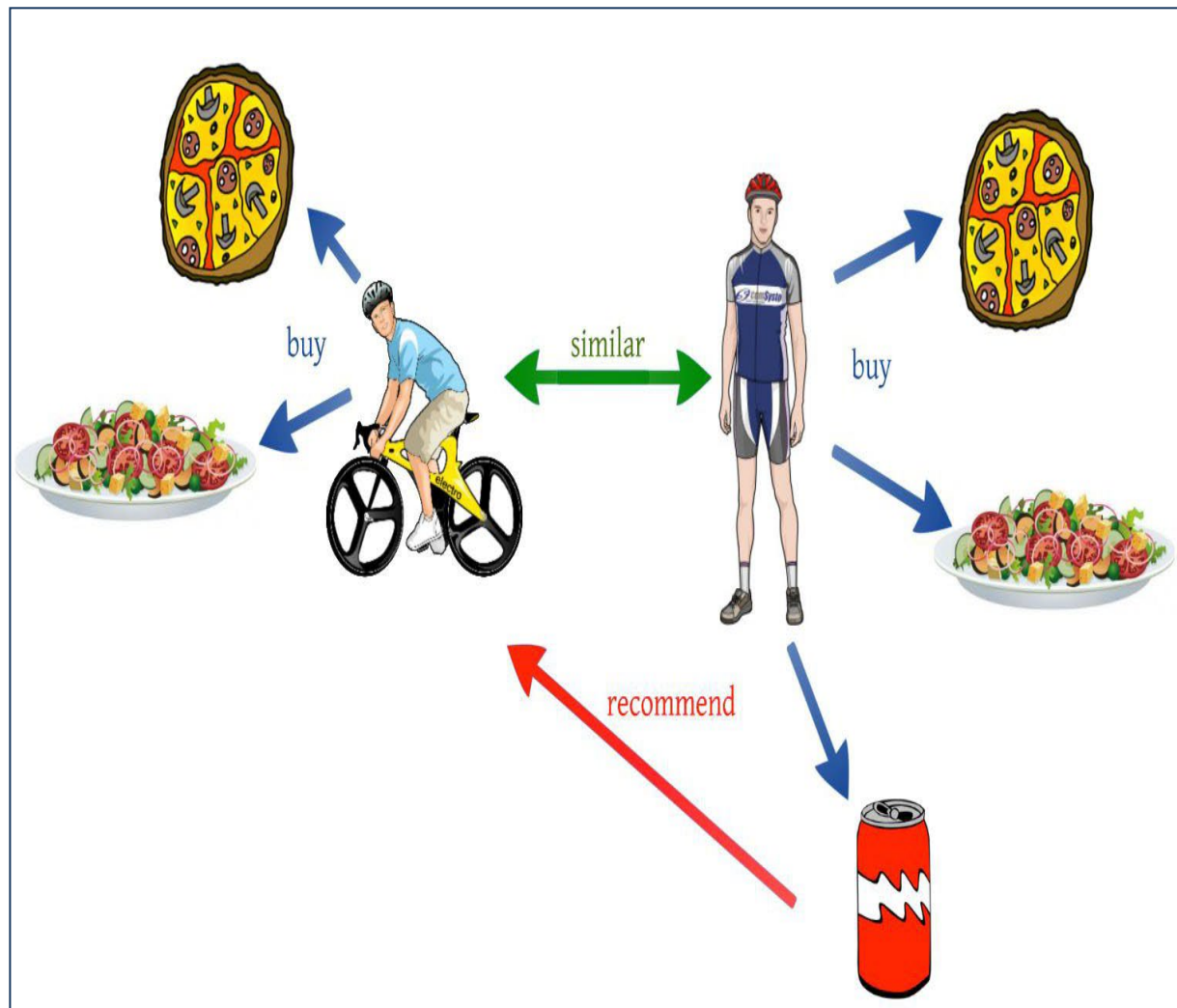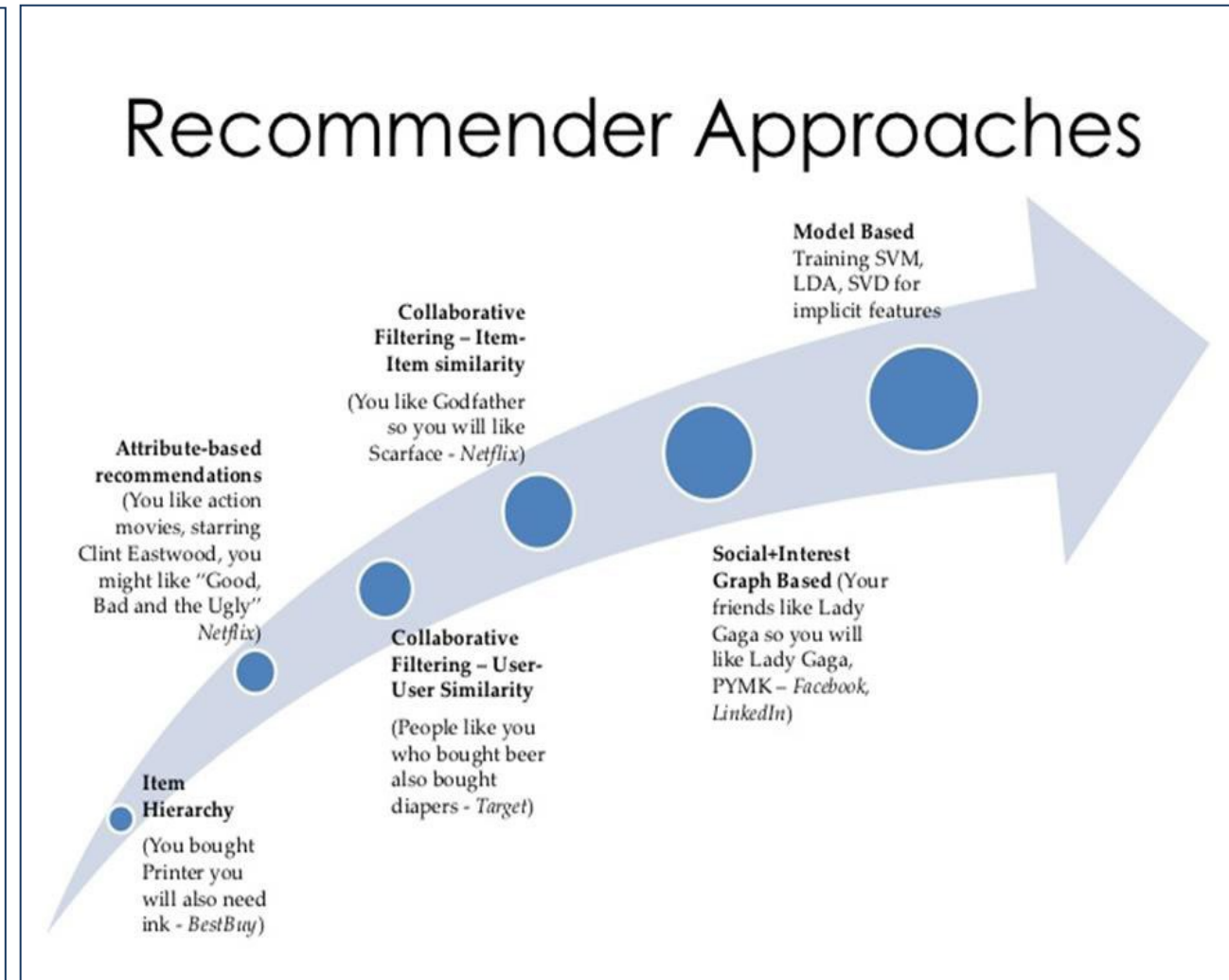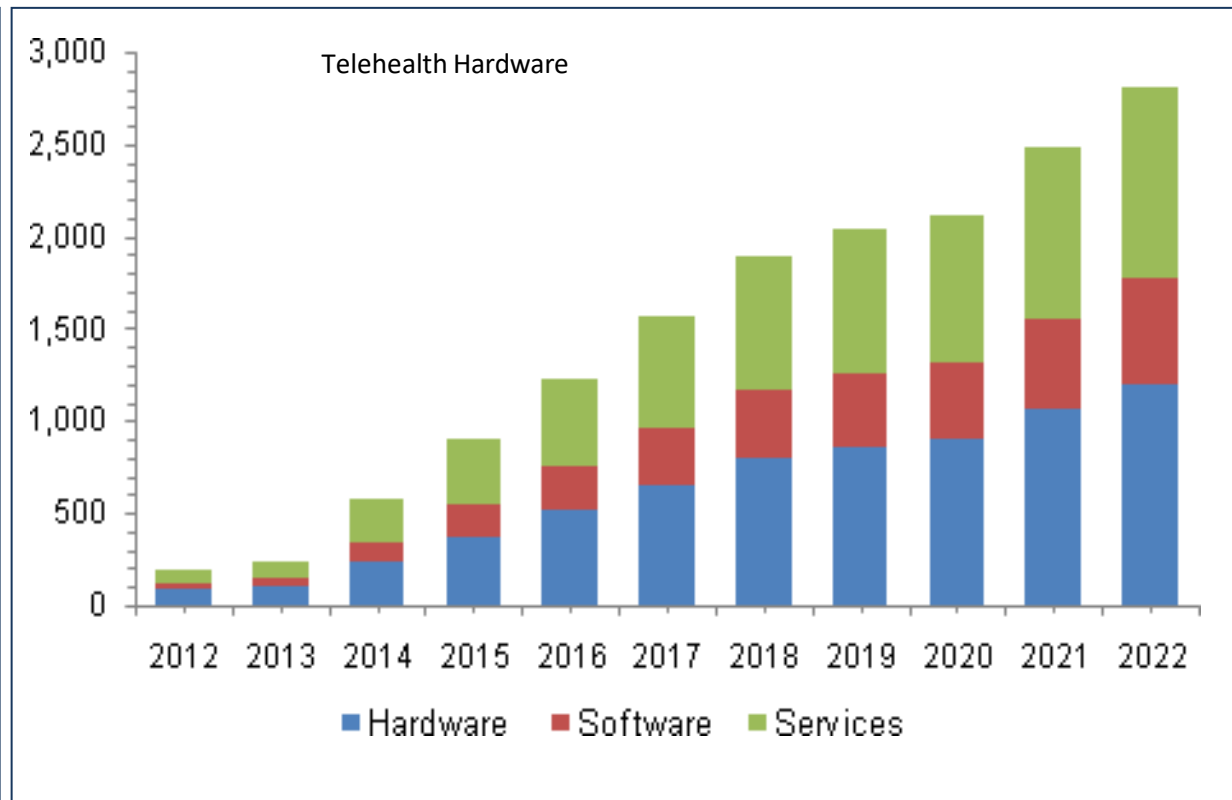
BU | Metropolitan College
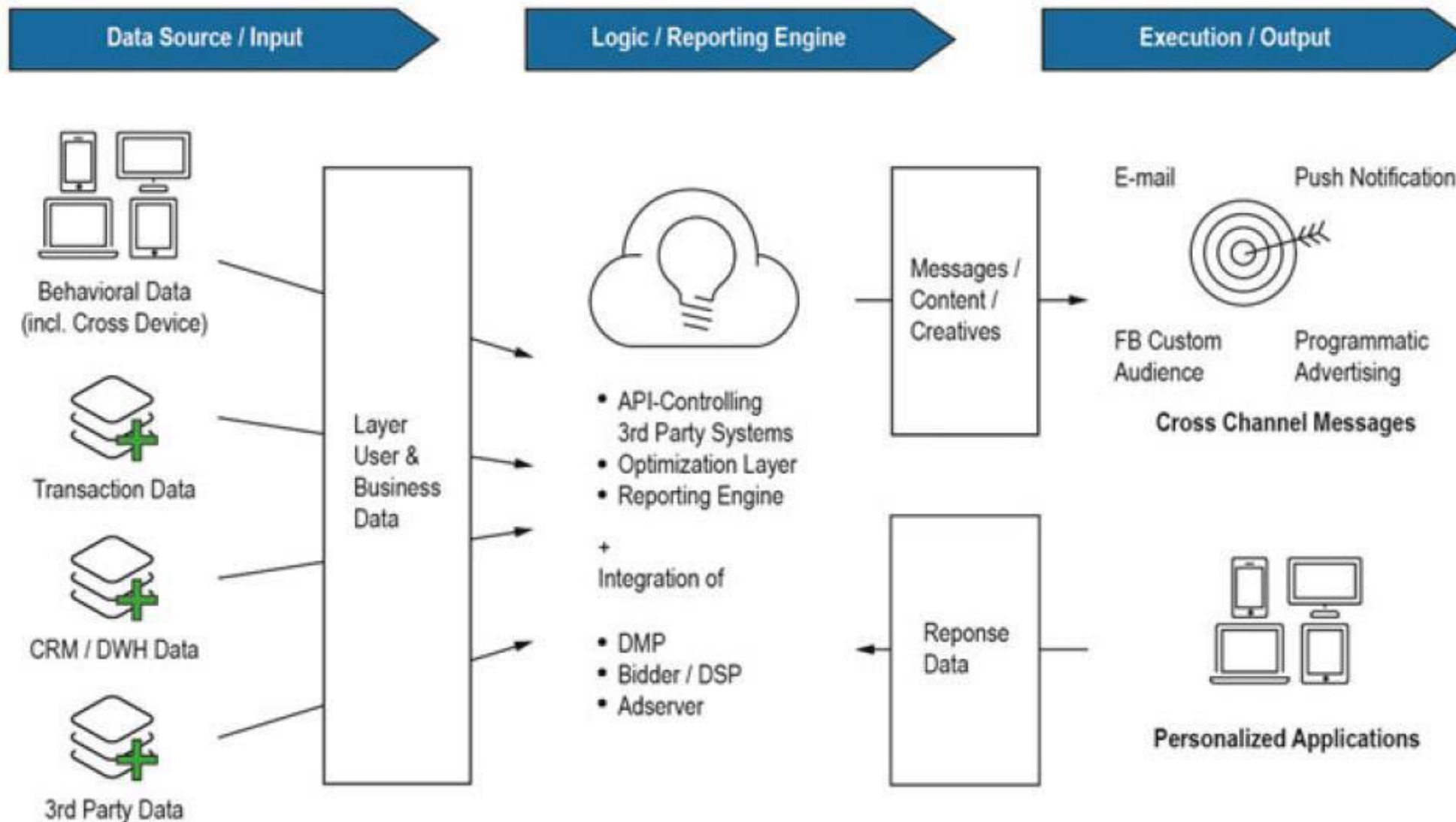
Source: Heinemann, F.(2016) Driving Performance with Programmatic CRM

(A)

Preparation for Week 4: Time Series

Single Exponential Smoothing

Quantity of Mountain-200
Black, 38
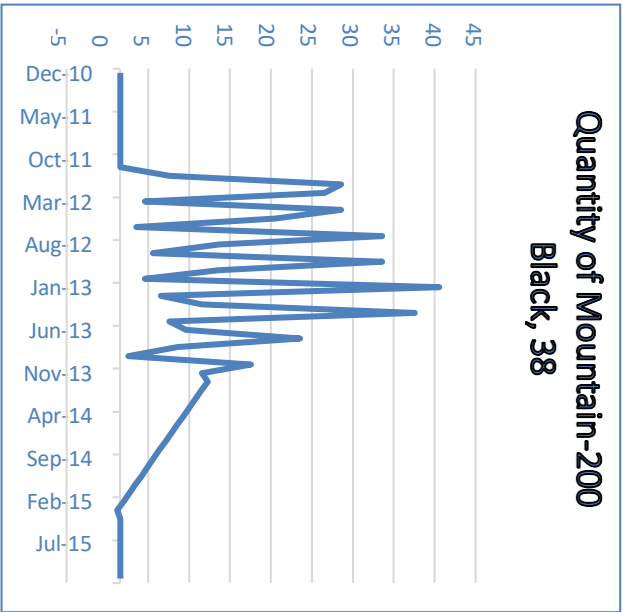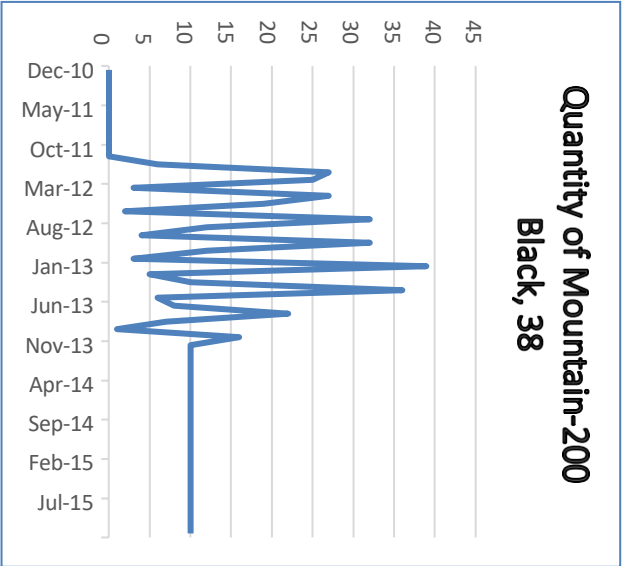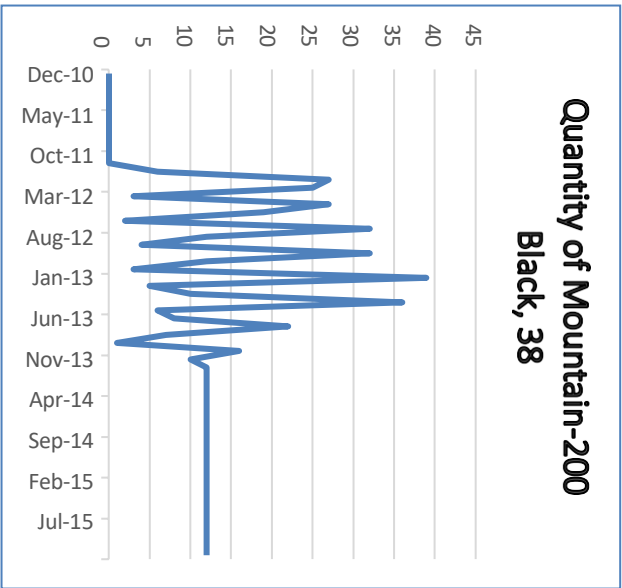
Mean Absolute Percentage Error (MAPE)	182.4256
Mean Absolute Deviation (MAD)	9.047372
Mean Square Error (MSE)	144.9178
Tracking Signal Error (TSE)	6.624276
Cumulative Forecast Error (CFE)	59.93229
Mean Forecast Error (MFE)	1.872884

Moving Averages

Quantity of Mountain-200
Black, 38

Mean Absolute Percentage Error (MAPE)	223.5788
Mean Absolute Deviation (MAD)	12.625
Mean Square Error (MSE)	290.5625
Tracking Signal Error (TSE)	0.792079
Cumulative Forecast Error (CFE)	10
Mean Forecast Error (MFE)	0.3125

Double Exponential Smoothing

Quantity of Mountain-200
Black, 38

Mean Absolute Percentage Error (MAPE)	234.7263
Mean Absolute Deviation (MAD)	9.811871
Mean Square Error (MSE)	140.8039
Tracking Signal Error (TSE)	-6.78919
Cumulative Forecast Error (CFE)	-66.6146
Mean Forecast Error (MFE)	-2.01862

Triple Exponential Smoothing

Quantity of Mountain-200
Black, 38

Mean Absolute Percentage Error (MAPE)	100
Mean Absolute Deviation (MAD)	11.0303
Mean Square Error (MSE)	266.2424
Tracking Signal Error (TSE)	33
Cumulative Forecast Error (CFE)	364
Mean Forecast Error (MFE)	11.0303
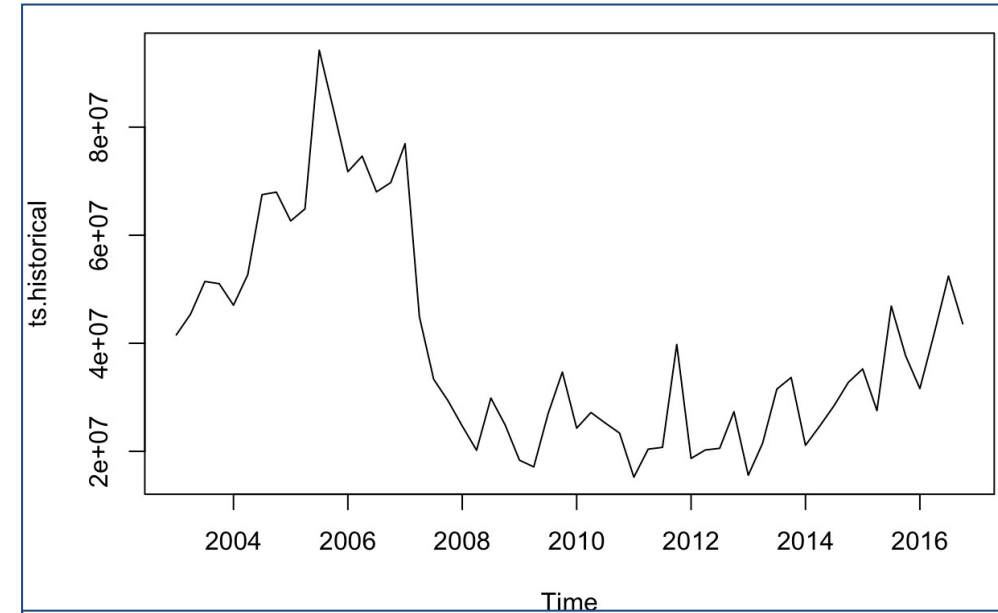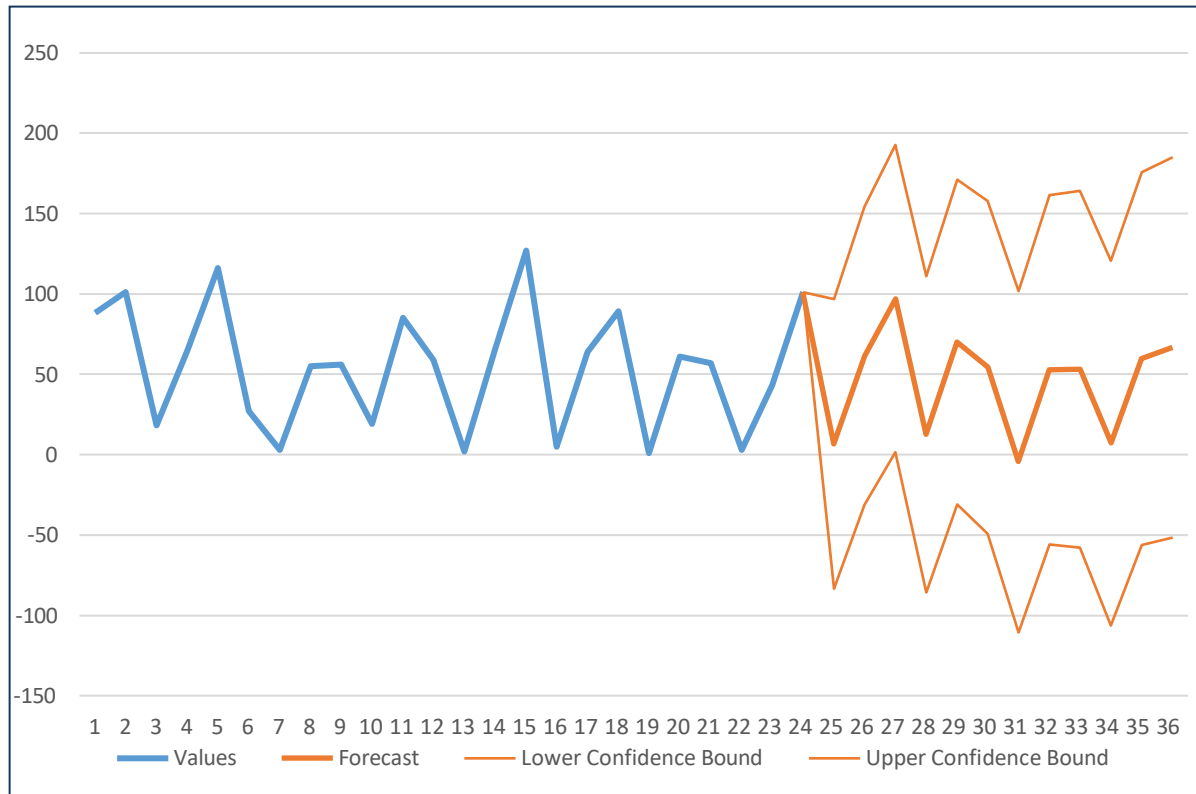
Forecasts from ETS(A,A,A)
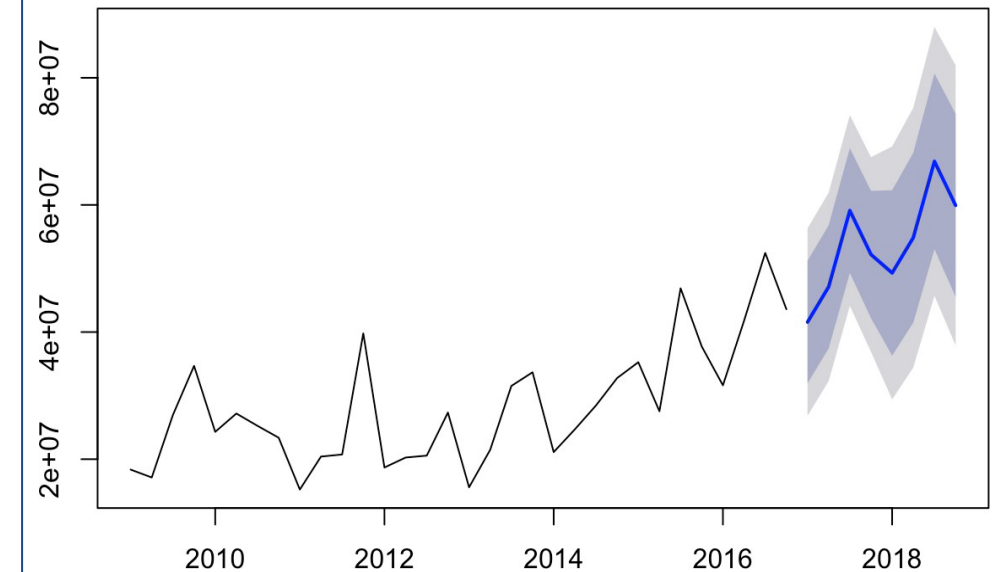
```
Residuals:
     Min        1Q    Median        3Q       Max
-20614597  -1849007         0   1740805  14013527

Coefficients:
                            Estimate    Std. Error  t value   Pr(>|t|)
(Intercept)             55087544.17370  59902286.93867    0.920    0.36053
BuildingClassFinalRollc0   -511829.05153   5291132.55548   -0.097    0.92318
BuildingClassFinalRollc1   1972963.67852   5201342.63481    0.379    0.70546
BuildingClassFinalRollc2   -915817.86150   5416380.66169   -0.169    0.86616
BuildingClassFinalRollc3   1568124.41688   5343466.16755    0.293    0.76993
BuildingClassFinalRollc4    787887.78238   5025496.19446    0.157    0.87581
BuildingClassFinalRollc6  -5369646.61639   6332651.59816   -0.848    0.39901
BuildingClassFinalRollc7   1807141.72312   5225211.73749    0.346    0.73036
BuildingClassFinalRollD1   4888684.81144   6252896.69410    0.782    0.43662
BuildingClassFinalRollD3   6666868.66283   7723701.02615    0.863    0.39062
BuildingClassFinalRollD6 -21913591.13592   6607430.12443   -3.317    0.00137  **
BuildingClassFinalRollD7   2409822.25663   5797734.15671    0.416    0.67878
BuildingClassFinalRollD9   8022386.72043   6343883.57492    1.265    0.20969
BuildingClassFinalRollR9  10255415.14753   8060905.28646    1.272    0.20697
BuildingClassFinalRollRR  11899477.69424   7855328.16592    1.515    0.13376
ResidentialUnits           -248544.32987     98603.65269   -2.521    0.01370  *
CommercialUnits             276046.95689    646323.23727    0.427    0.67045
GrossSqFt                      794.17103        95.95051    8.277  0.00000000000232  ***
SaleDate                         0.03094         0.01027    3.012    0.00348  **
YearBuilt                   -50845.34076     31243.58536   -1.627    0.10759
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 4819000 on 80 degrees of freedom
Multiple R-squared:  0.8447,    Adjusted R-squared:  0.8079
F-statistic: 22.91 on 19 and 80 DF,  p-value: < 0.00000000000000022
```

Why we will use Adjusted R-squared

• R^2 will often increase if you add more predictors to the model
• A large R-squared may be an outcome of adding more predictor to the model
• We make use of the adjusted R-squared to account for the number of predictor in the model

How do I know which variables to add?

Generally, additional variables should have:
- Theoretical validity
- Explanatory power
- Avoid high correlation with another explanatory variable
-   >.6 correlation is the standard cut-off.