Class 15a: Predicting Attrition

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MKTG 482: Customer Analytics
Kellogg School of Management

Customer Analytics Course Structure

Customer Centric Marketing
- Customer Analytics and AI Overview (Class 1)
  AI and Analytics,
  Why Customer Analytics and AI Needs Customer Centricity

Getting Ready for Analytics
- Using R for Customer Analytics and AI (Class 2)
- Statistics Review (Class 3)

Targeting Customers for Acquisition and Development
- Predicting Response with RFM analysis (Class 4)
- Case Analysis: "Tuango: RFM Analysis for Mobile App Push Messaging" (Class 5)
  Lift and Gains
- Predicting Response with Logistic Regression (Class 6)
- Predicting Response with Neural Networks (Class 7)
- Using Neural Networks for Customer Analytics and AI (Class 8)
  Training Machine Learning Models
- Case Analysis: Intuit QuickBooks Upgrade: Moving to the Cloud (Class 9)
- Predicting Response with Tree Methods (Class 10)

Targeting based on Incrementality
- From Propensity to Uplift (Class 11)
- The Causality Checklist (Class 12)
- Case Analysis: Creative Gaming Uplift Modeling (Class 13)
- Hyper-Personalization: Next-Product-to-Buy Models (Class 14)

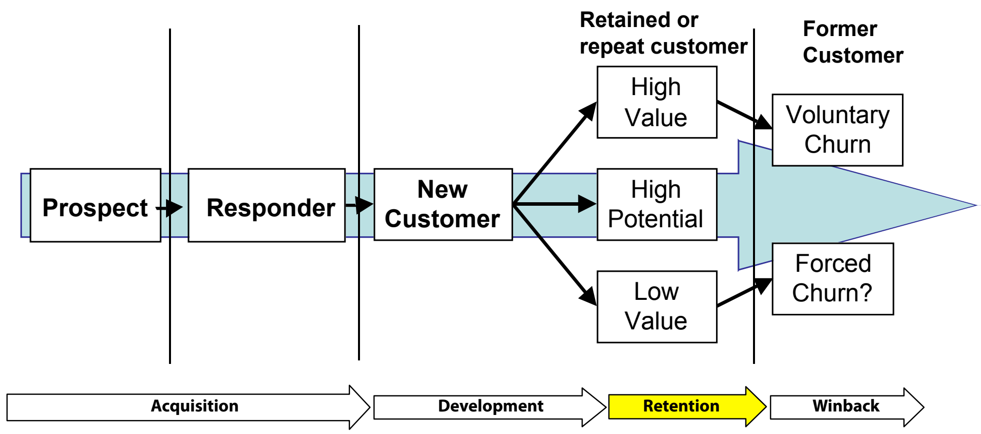
Retaining Customers
- Predicting Attrition (Class 15)
- Linking Analytics with a Business Outcomes Model (Class 16)
- Case Analysis: "S-Mobile: Churn Management" (Class 17)
  From Prediction to Action

Selecting the Right Offers
- Design of Experiments / Multivariate Testing (Class 18)
- Case Analysis: "Capital One: Information-Based Credit Card Design" (Class 19)

Scaling Analytics
- Scaling Analytics in Practice (Class 20)
  Course Wrap-up

We now consider how we can use information based marketing to postpone the end of the customer lifecycle

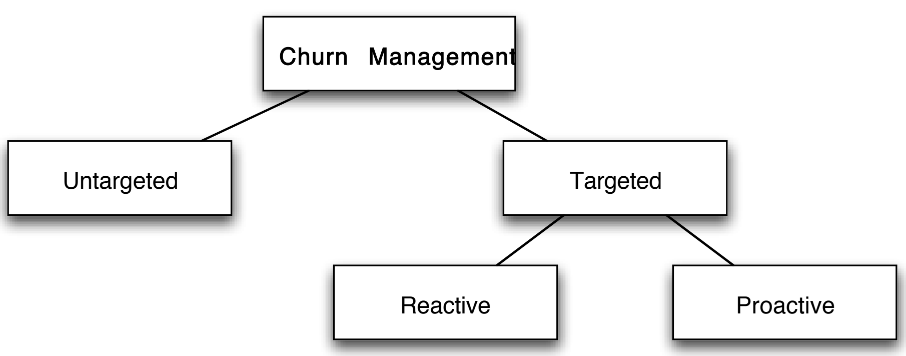
APPLICATIONS OF PREDICTIVE TECHNIQUES



- Modeling and predicting response rates
- Modeling and predicting the success of cross/up-sell attempts
- Modeling and predicting customer attrition
- Modeling and predicting "reactivation" success

Retention strategies (churn management) have historically been untargeted

APPROACHES TO CHURN MANAGEMENT



- Improvements in product quality
- Mass advertising

- Contact customers at the time or **after** he/she churns

- Contact customers **before** he/she churns

How can predictive analytics help?

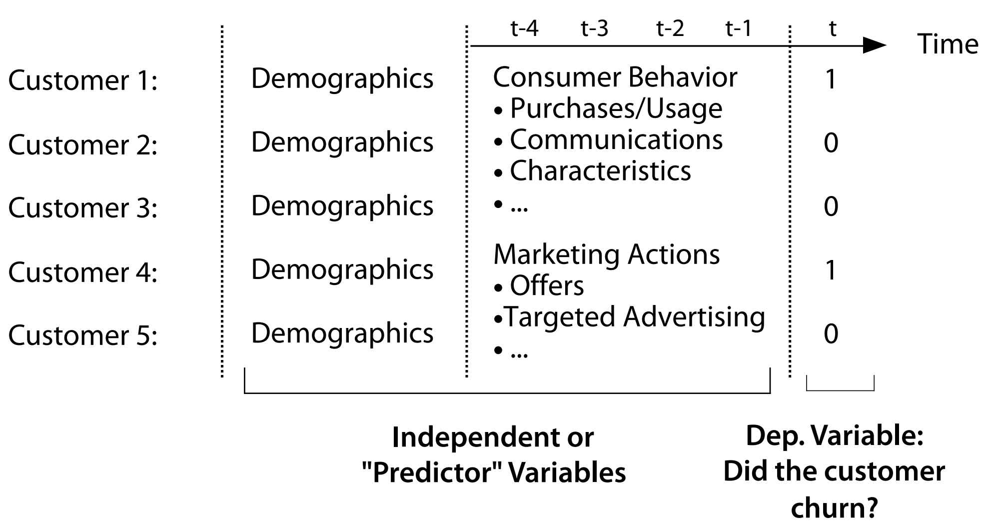
CONTRIBUTIONS OF PREDICTIVE ANALYTICS

- **Predict individual churn probabilities**
- *Example:*
  - Overall (baseline) churn rate is 20% per year
  - With model identify customers who have 30%, 40%, etc. churn rate

- **Determine which factors lead to the highest success rate, i.e. are most likely to change attrition behavior**
- *Example:*
  - Model reveals that customers with a tech support wait time exceeding 5 minutes are more likely to leave
  - Give priority to customers who are likely to churn

We need attrition data to develop a retention model

REQUIRED DATA FOR RETENTION MODEL



We will design a churn management program for Netflix

NETFLIX EXAMPLE*

NETFLIX

- Largest DVD by mail provider
- 4 MM customers 2006
- High recurrent revenue
- Revenue sharing with movie studios, pay $1.5 per rental

Membership Plans

8 at-a-time (Unlimited) for $47.99
Unlimited rentals - up to 8 movies out at a time for a flat monthly fee of $47.99.

7 at-a-time (Unlimited) for $41.99
Unlimited rentals - up to 7 movies out at a time for a flat monthly fee of $41.99.

6 at-a-time (Unlimited) for $35.99
Unlimited rentals - up to 6 movies out at a time for a flat monthly fee of $35.99.

5 at-a-time (Unlimited) for $29.99
Unlimited rentals - up to 5 movies out at a time for a flat monthly fee of $29.99.

4 at-a-time (Unlimited) for $23.99
Unlimited rentals - up to 4 movies out at a time for a flat monthly fee of $23.99.

You are currently on this plan:
3 at-a-time (Unlimited) for $17.99
Unlimited rentals - up to 3 movies out at a time for a flat monthly fee of $17.99.

2 at-a-time (Unlimited) for $14.99
Unlimited rentals - up to 2 movies out at a time for a flat monthly fee of $14.99.

1 at-a-time (Unlimited) for $9.99
Unlimited rentals - up to 1 movie out at a time for a flat monthly fee of $9.99.

*The numbers used in this example are hypothetical and should not be considered an accurate reflection of churn at Netflix

3 at-a-time is the most popular plan

PLAN POPULARITY AND USAGE

Plan	Montly Price ($)	Customers	Av. Mo. Usage
1	9.99	5.2%	2.3
2	14.99	10.6%	3.8
3	17.99	53.6%	5.1
4	23.99	20.1%	6.1
5	29.99	3.2%	7.3
6	35.99	1.8%	8.5
7	41.99	1.0%	11.1
8	47.99	4.5%	13.3
		100.0%	

CHURN PROBLEM

- Churn rate 1.34% per month
  = 14.95% per year (=1-(1-0.0134)^12)
- After 4 years, 50% of a cohort has churned

We will develop a proactive churn management program

CHURN MANAGEMENT STEPS

1. Develop a model to **predict** customer churn
2. Use model to **understand** main drivers of churn
3. Use insights to **develop** actions/offers/incentives
4. Estimate the **impact** of these actions/offers/incentives on the probability of churn
5. Decide which actions/offers/incentives to **target** to **which customers**
6. **Evaluate** the economics

We have a rich set of variables to predict attrition

NETFLIX DATA

- **Dependent variable:**
  Did customer cancel Netflix in January 2006?
- **Independent variables:**

Predictor Variable	Dummy	Mean	St. Dev.	Min	Max
Current plan (# concurrent DVDs)	0	3.37	1.40	1	8
Total # of Movies	0	33.87	21.94	0	141
Av. Monthly Change in # Movies	0	0.20	0.78	-7	9
Average Shipping Delay	0	0.45	0.62	0	8
Lowest 10% in #movies for plan	1	0.10	0.30	0	1.000
# Reported scratched	0	0.60	0.84	0	5
# Reported missing	0	0.30	0.41	0	6
Moved in last 6 months?	1	0.12	0.33	0	1
Average movie rating	0	3.53	0.83	2.1	4.96
Age 60+	1	0.18	0.39	0	1
Called Cust Service to request HD-DVD	1	0.08	0.27	0	1
Resulted from a referral	1	0.27	0.45	0	1

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The coefficients from the model suggest that a number of factors drive people away

RESULTS LOGISTIC REGRESSION

Variable	Estimate	Std. Error	z-value	p-value
Current plan (# concurrent DVDs)	0.048	0.044	1.092	0.275
Total # of Movies	0.002	0.002	1.412	0.158
Av. Monthly Change in # Movies	-0.386	0.164	-2.357	0.018
Average Shipping Delay	0.233	0.076	3.076	0.002
Lowest 10% in #movies for plan	0.770	0.285	2.706	0.007
# Reported scratched	0.351	0.105	3.330	0.001
# Reported missing	0.191	0.079	2.423	0.015
Moved in last 6 months?	0.113	0.124	0.915	0.360
Average movie rating	0.020	0.010	1.951	0.051
Age 60+	-0.197	0.066	-2.968	0.003
Called Cust Service to request HD	0.523	0.252	2.075	0.038
Resulted from a referral	-0.311	0.117	-2.656	0.008

Next, we determine the relative importance of factor for predicting churn

PREDICTORS BY IMPORTANCE

variable	factor	var_imp	var_imp_lower	var_imp_upper	p-value
Lowest 10% in #movies for plan	1	0.770	0.212	1.328	0.007
Av. Monthly Change in # Movies	0	-0.602	-1.102	-0.101	0.018
# Reported scratched	0	0.591	0.243	0.938	0.001
Called Cust Service to request HD	1	0.523	0.029	1.017	0.038
Resulted from a referral	1	-0.311	-0.540	-0.081	0.008
Average Shipping Delay	0	0.291	0.106	0.476	0.002
Age 60+	1	-0.197	-0.327	-0.067	0.003
# Reported missing	0	0.158	0.030	0.285	0.015
Current plan (# concurrent DVDs)	0	0.133	-0.106	0.371	0.275
Moved in last 6 months?	1	0.113	-0.129	0.356	0.360
Total # of Movies	0	0.105	-0.041	0.251	0.158
Average movie rating	0	0.033	0.000	0.066	0.051

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What should Netflix do to reduce customer churn?

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- Ideas?

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- For each predictor in turn, consider:
  - Is this predictor actionable?
  - If so, where in the customer lifecycle would be the place the act?
  - And what action / offer would you make at that place in the customer lifecycle?

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There are two ways to predict the effect of an action/ incentive/offer on the predicted probability of churn

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PREDICTING IMPACT

1. **Simulate the effect of a churn driver** by changing the value of the variable and using the estimated logistic regression model to obtain new churn predictions
2. **Test the action/incentive/offer** in the field

There are two ways to predict the effect of an action/incentive/offer on the predicted probability of churn

PREDICTING IMPACT

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R Demo

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To ensure that a test feasible, answer these three questions

QUESTIONS	WATCH OUT
1. Do I have the technology or capability of randomly targeting units (e.g., customers, channel partners, etc.)?	• "Close enough" randomization • Is it possible? (e.g., do business constraints limit random assignment of offers)

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3. What is the size of my overall sample for the experiment?	• Precision requirements • Others to be discussed in R demo

Q: How large does my sample need to be?
A: How precisely do you want to estimate the proportion?

REVIEW

- Recall the the formula the 95% confidence interval for a proportion:

$$\hat{p} \pm 1.96\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

- The precision (as assessed by the interval halfwidth) is $1.96\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$

- The confidence level of 95% determines $z_{1-\frac{0.05}{2}} = 1.96$

- So, for a desired level of precision and confidence, we can set the sample size via

$$\mathrm{hw} = 1.96\sqrt{\frac{\hat{p}(1-\hat{p})}{n}} \qquad \Rightarrow \qquad n = \frac{1.96^2\hat{p}(1-\hat{p})}{\mathrm{hw}^2}$$

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PREDICTING IMPACT

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In the S-mobile case, which method might you choose for which churn action/incentive/offer?

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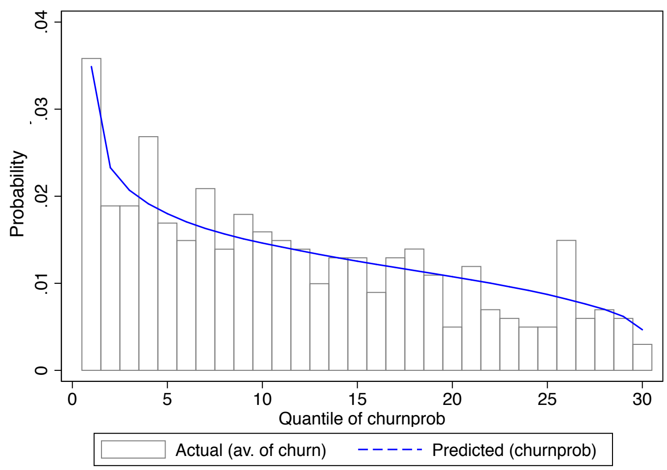
Given an estimate of the effect of a churn action/incentive/offer, how should the absolute churn probability factor in?

PREDICTED CHURN IN REPRESENTATIVE SAMPLE



In the S-mobile case, consider how a customer's absolute churn probability should affect the selection of that customer for churn actions

A plan specifies an action/incentive/offer and a rule for selecting customers

EXAMPLE OF CHURN PLAN FOR NETFLIX EXAMPLE

1. **Action**: *Eliminate average shipping delay*
   Targeting rule: None, affects all customers
   Expected churn benefit: Baseline churn: 1.34%, projected churn: 1.25%

2. **Action**: *Offer consumer plan downgrade*
   Targeting rule: Consumer is in lowest 10% of usage in their respective plan
   Consumer has above average total churn probability
   Expected churn benefit: Baseline churn 3.2%, projected churn 2.0%

3. ...

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3. ...

How do we link churn to business outcome metrics?

What is it worth to eliminate average shipping delays to our company (for 3 at-a-time customer)?

LTV FOR 3 AT-A-TIME DVD PLAN

	Now	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	
Revenue	$0	$216	$216	$216	$216	$216	$216	
Product/Service Cost	$0	$122	$122	$122	$122	$122	$122	
Action/Offer/Incentive Cost	$0	$0	$0	$0	$0	$0	$0	
Profit	$0	$93	$93	$93	$93	$93	$93	
Prob. active at end of period	100%	85%	72%	62%	52%	45%	38%	
Prob. active within period	100%	93%	79%	67%	57%	48%	41%	
Expected Profit	$0	$86	$74	$63	$53	$45	$38	
Present Value of Exp. Profit	$0	$82	$64	$49	$38	$29	$23	$286

Baseline churn: 1.34%
Yearly: 1-(1-0.0134)^12 = 14.95%

Projected churn: 1.25%
Yearly: 1-(1-0.0125)^12 = 14.0%

	Now	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	
Revenue	$0	$216	$216	$216	$216	$216	$216	
Product/Service Cost	$0	$122	$122	$122	$122	$122	$122	
Action/Offer/Incentive Cost	$0	$0	$0	$0	$0	$0	$0	
Profit	$0	$93	$93	$93	$93	$93	$93	
Prob. active at end of period	100%	86%	74%	64%	55%	47%	40%	
Prob. active within period	100%	93%	80%	69%	59%	51%	44%	
Expected Profit	$0	$87	$75	$64	$55	$48	$41	
Present Value of Exp. Profit	$0	$83	$65	$51	$40	$31	$24	$293

Value of Churn Program:
$7 per subscriber

Suppose we could eliminate these delays with a one-time payment

LTV FOR 3 AT-A-TIME DVD PLAN

	Now	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	
Revenue	$0	$216	$216	$216	$216	$216	$216	
Product/Service Cost	$0	$122	$122	$122	$122	$122	$122	
Action/Offer/Incentive Cost	$0	$0	$0	$0	$0	$0	$0	
Profit	$0	$93	$93	$93	$93	$93	$93	
Prob. active at end of period	100%	85%	72%	62%	52%	45%	38%	
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Revenue	$0	$216	$216	$216	$216	$216	$216	
Product/Service Cost	$0	$122	$122	$122	$122	$122	$122	
Action/Offer/Incentive Cost	$7	$0	$0	$0	$0	$0	$0	
Profit	-$7	$93	$93	$93	$93	$93	$93	
Prob. active at end of period	100%	86%	74%	64%	55%	47%	40%	
Prob. active within period	100%	93%	80%	69%	59%	51%	44%	
Expected Profit	-$7	$87	$75	$64	$55	$48	$41	
Present Value of Exp. Profit	-$7	$83	$65	$51	$40	$31	$24	$286

Can spend up to:
$7 per subscriber now

However eliminating average shipping delays is perhaps better modeled as on ongoing cost

LTV FOR 3 AT-A-TIME DVD PLAN

	Now	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	
Revenue	$0	$216	$216	$216	$216	$216	$216	
Product/Service Cost	$0	$122	$122	$122	$122	$122	$122	
Action/Offer/Incentive Cost	$0	$0	$0	$0	$0	$0	$0	
Profit	$0	$93	$93	$93	$93	$93	$93	
Prob. active at end of period	100%	85%	72%	62%	52%	45%	38%	
Prob. active within period	100%	93%	79%	67%	57%	48%	41%	
Expected Profit	$0	$86	$74	$63	$53	$45	$38	
Present Value of Exp. Profit	$0	$82	$64	$49	$38	$29	$23	$286

Baseline churn: 1.34%
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Product/Service Cost	$0	$122	$122	$122	$122	$122	$122	
Action/Offer/Incentive Cost	$0.0	$2.3	$2.3	$2.3	$2.3	$2.3	$2.3	
Profit	$0	$91	$91	$91	$91	$91	$91	
Prob. active at end of period	100%	86%	74%	64%	55%	47%	40%	
Prob. active within period	100%	93%	80%	69%	59%	51%	44%	
Expected Profit	$0	$85	$73	$63	$54	$46	$40	
Present Value of Exp. Profit	$0	$81	$63	$49	$39	$30	$24	$286

Can spend up to:
$2.3 per year per subscriber

What we can spend depends on the type of customer (now consider 4-at-a-time plan)

LTV FOR 4 AT-A-TIME DVD PLAN

	Now	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	
Revenue	$0	$288	$288	$288	$288	$288	$288	
Product/Service Cost	$0	$146	$146	$146	$146	$146	$146	
Action/Offer/Incentive Cost	$0	$0	$0	$0	$0	$0	$0	
Profit	$0	$142	$142	$142	$142	$142	$142	
Prob. active at end of period	100%	85%	72%	62%	52%	45%	38%	
Prob. active within period	100%	93%	79%	67%	57%	48%	41%	
Expected Profit	$0	$131	$111	$95	$81	$69	$58	
Present Value of Exp. Profit	$0	$125	$97	$75	$58	$45	$35	$433

Baseline churn: 1.34%
Yearly: 1-(1-0.0134)^12 = 14.95%

Projected churn: 1.25%
Yearly: 1-(1-0.0125)^12 = 14.0%

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Product/Service Cost	$0	$146	$146	$146	$146	$146	$146	
Action/Offer/Incentive Cost	$0.0	$3.5	$3.5	$3.5	$3.5	$3.5	$3.5	
Profit	$0	$138	$138	$138	$138	$138	$138	
Prob. active at end of period	100%	86%	74%	64%	55%	47%	40%	
Prob. active within period	100%	93%	80%	69%	59%	51%	44%	
Expected Profit	$0	$128	$110	$95	$82	$70	$60	
Present Value of Exp. Profit	$0	$122	$96	$75	$58	$46	$36	$433

Can spend up to:
$3.5 per year per subscriber
(was $2.3 for 3-at-a-time)

A plan specifies an action/incentive/offer and a rule for selecting customers

EXAMPLE OF CHURN PLAN FOR NETFLIX EXAMPLE

1. **Action:** *Eliminate average shipping delay*
   Targeting rule: None, affects all customers
   Expected churn benefit: Baseline churn: 1.34%, projected churn: 1.25%
2. **Action:** *Offer consumer plan downgrade*
   Targeting rule: Consumer is in lowest 10% of usage in their respective plan
   Consumer has above average total churn probability
   Expected churn benefit: Baseline churn 3.2%, projected churn 2.0%
3. ...

What is the benefit of downgrading consumers from the 4 to the 3-at a time plan (usage is 3.1 vs. 6.1)?

LTV FOR 4 AT-A-TIME DVD PLAN

	Now	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	
Revenue	$0	$288	$288	$288	$288	$288	$288	
Product/Service Cost	$0	$74	$74	$74	$74	$74	$74	
Action/Offer/Incentive Cost	$0	$0	$0	$0	$0	$0	$0	
Profit	$0	$214	$214	$214	$214	$214	$214	
Prob. active at end of period	100%	67.7%	45.8%	31.0%	21.0%	14.2%	9.6%	
Prob. active within period	100%	84%	57%	38%	26%	18%	12%	
Expected Profit	$0	$179	$121	$82	$56	$38	$25	
Present Value of Exp. Profit	$0	$171	$105	$65	$40	$24	$15	$420

Baseline churn: 3.2%
Yearly: 1-(1-0.032)^12 = 32.3%

Projected churn: 2.00%
Yearly: 1-(1-0.02)^12 = 21.5%

	Now	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	
Revenue	$0	$216	$216	$216	$216	$216	$216	
Product/Service Cost	$0	$74	$74	$74	$74	$74	$74	
Action/Offer/Incentive Cost	$0	$0	$0	$0	$0	$0	$0	
Profit	$0	$141	$141	$141	$141	$141	$141	
Prob. active at end of period	100%	78%	62%	48%	38%	30%	23%	
Prob. active within period	100%	89%	70%	55%	43%	34%	27%	
Expected Profit	$0	$126	$99	$78	$61	$48	$38	
Present Value of Exp. Profit	$0	$120	$86	$61	$44	$31	$22	$365

Value of Churn Program:
Loss of $55 per subscriber

-> don't implement

CHURN MANAGEMENT STEPS

1. Develop a model to **predict** customer churn
2. Use model to **understand** main drivers of churn
3. Use insights to **develop** actions/offers/incentives
4. Estimate the **impact** of these actions/offers/incentives on the probability of churn
5. Decide which actions/offers/incentives to **target** to **which customers**
6. **Evaluate** the economics

Customer Analytics Course Structure

Customer Centric Marketing

- Customer Analytics and AI Overview (Class 1)
  AI and Analytics,
  Why Customer Analytics and AI Needs Customer Centricity

Getting Ready for Analytics

- Using R for Customer Analytics and AI (Class 2)
- Statistics Review (Class 3)

Targeting Customers for Acquisition and Development

- Predicting Response with RFM analysis (Class 4)
- Case Analysis: “Tuango: RFM Analysis for Mobile App Push Messaging” (Class 5)
  Lift and Gains
- Predicting Response with Logistic Regression (Class 6)
- Predicting Response with Neural Networks (Class 7)
- Using Neural Networks for Customer Analytics and AI (Class 8)
  Training Machine Learning Models
- Case Analysis: Intuit QuickBooks Upgrade: Moving to the Cloud (Class 9)
- Predicting Response with Tree Methods (Class 10)

Targeting based on Incrementality

- From Propensity to Uplift (Class 11)
- The Causality Checklist (Class 12)
- Case Analysis: Creative Gaming Uplift Modeling (Class 13)
- Hyper-Personalization: Next-Product-to-Buy Models (Class 14)

Retaining Customers

- Predicting Attrition (Class 15)
- Linking Analytics with a Business Outcomes Model (Class 16)
- Case Analysis: “S-Mobile: Churn Management” (Class 17)
  From Prediction to Action

Selecting the Right Offers

- Design of Experiments / Multivariate Testing (Class 18)
- Case Analysis: “Capital One: Information-Based Credit Card Design” (Class 19)

Scaling Analytics

- Scaling Analytics in Practice (Class 20)
  Course Wrap-up