

Analytics Manager Assignment

Section 1: Customer Retention Analysis

1.a.i

Marginal cost from subsidy (cash bonus) = 500

Marginal revenue from reduced churn = $10\% * 55\% * (9000 - 100) = 445.5$

Marginal revenue < Marginal cost. Therefore, offering bonus to everyone may not be a great idea.

Assumptions

- No externalities or network effect from the additional retained numbers. This may not be true, especially in case of multi-player games
- The untapped market is huge so that the bonus in no way is affecting the # people on-boarded every month (3000)
- Bonus of 500 has same cost to company

1.a.ii

CPA has no effect on the marginal gains/losses arising out of the bonus. Hence, the recommendation provided above remains same.

(Also, the with CPA of 500, the retention rate is 90%. Adding bonus would effectively double acquisition costs to 1000 with merely 5.5% increase in the retention rate. Since the market is hugely untapped, it may be better if we venture for aggressive acquisition than retention by doubling the effective cost. However, since it is assumed that a fixed number is being onboarded every month, this aspect is not taken into consideration in the above solutions)

1.b

Assumptions

- LTV for every user who stays after the first year is, on an average, assumed to be \$9000, irrespective of their initial deposit
- 55% of users who would have otherwise churned is retained because of bonus. This is same across all the segments
- In the segment with FDA ≥ 500 , only few outliers exist with very high FDA
- GG's revenue is a cut (10% percentage) of the deposits which players make

ROI = linear F^n (increase in retention, increase in revenue from retained people)

Since the focus is on ROI, the focus would be on segments which would provide,

- higher reduction in the defection rate. Since the decrease in churn rate (55%) is constant, we should focus on segments with higher initial defection rate.
- highest possible gain in terms of LTV (in this case, \$9000 – f^n (initial deposit)).

The following segments has the highest defection rate,

Segment	Defectors	FDA
Segment - 1	21%	<=100
Segment - 2	17%	101-200
Segment - 4	21%	>=500
Segment - 5	18%	<=100
Segment - 6	16%	101-200
Segment - 9	14%	<=100
Segment - 10	14%	101-200

The maximum revenue GG is getting is 500 (based on 10% of deposit assumption as stated above). In this case, the LTR difference between the person having least deposit (25) and maximum deposit (5000) is ~500, i.e., 5.5% of average LTR.

Therefore, we can focus on defector percentages alone as the percentage differences across segments are more and this would play a bigger role in determining winners. However, as segment 9 and 10 has same defector percentage, I would go with segment 9 as it has a lower FDA. (Again, this is based on the assumption that all these segments have the same average LTR).

The top 6 segments to increase ROI is shaded in blue.

Recommendation

- We should identify average LTR for each segment, rather than assuming INR 9000 for all customers. It may be unrealistic to assume that a person making a FTD of 25 and FTD of 500 will give the same LTR.
- Clusters to be made using more parameters to better target the potential defectors For example,
 - Presence of competitor/related apps on phone (if this data is available)
 - Kind of device used by the customer (OS, approximate cost)
 - Location (e.g., teen patti may be popular among old people in delhi while it may be rare in kerala)
 - Source of customer acquisition (If customer joined through referral or through a fb page link, the defection rate may be different.

2.

a. March 19 – Referral Campaign

- May lead to acquisition of new customers who are forced by the existing customers. This could lead to lot of attrition after day 1.
- The existing customers themselves may login using a different email id (work, college, different personal id) if there are no other restrictions like PAN verification to earn free referral bonus. This again, could lead to an apparent increase in customer base, but decrease in retention.
- Impact on day 1 retention – Medium

b. March 20 – Raising minimum deposit

- 25 - 40 is not a big psychological jump. This may not affect most people. However, there will be a few who feel bad about the hike and who may discontinue.
- It is unlikely to have a continuous effect in the day 1 retention rate since every new user (since March 20) becomes a cash player by depositing at least 40.
- Impact on day 1 retention – low

c. March 21 - FF increase joining bonus

- Will definitely induce attrition on GG.
- May have a long lasting effect
- Impact on day 1 retention – high, especially if FF bombard the users with ads based on the impressions.

d. March 22 – GG introduce additional security measures

- May have a negative effect on a section of population
- May have a positive effect on a set of customers, especially educated and high stake players
- Either way, this may have a significant and long lasting effect

e. March 23 – GG matches FF offer

- Should have a positive effect on the registration, involvement and retention
- Impact – high, nullifies the changes in March 21

f. March 15 – Faster landing page

- Should have a positive impact on the conversion.
- However, the effect on retention may be nil or negative as more non-enthusiastic players may also get converted.
- Impact – low, long lasting.

Ranking the changes from highest (magnitude) impact to lowest impact in Day1 retention rate,

GG increasing bonus > FF increasing bonus > Referral program > Raising min deposit > Additional security measure > Faster landing page

3.a.

The simple average of Y1_Ret across all regions would increase. However, a weighted average (a better metric for the company as a whole) can decrease owing to the change in relative weights (in this case, the total insurance issued in each region) for different region.

The situation is very much possible and may illustrated through an example

2017

2017	New customers	Renewed	Y1_Ret
North	100	99	99%
South	100	61	61%
East	100	98	98%
West	100	62	62%
Central	100	80	80%
Total	500	400	80%

2018

2018	New customers	Renewed	Y1_Ret
North	50	50	100%
South	200	127	64%
East	50	50	100%
West	100	65	65%
Central	100	83	83%
Total	500	375	75%

As we can see above, in 2018, each region, in terms of retention rate bettered their records. However, the retention rate at the overall company level dipped.

b) Few similar cases,

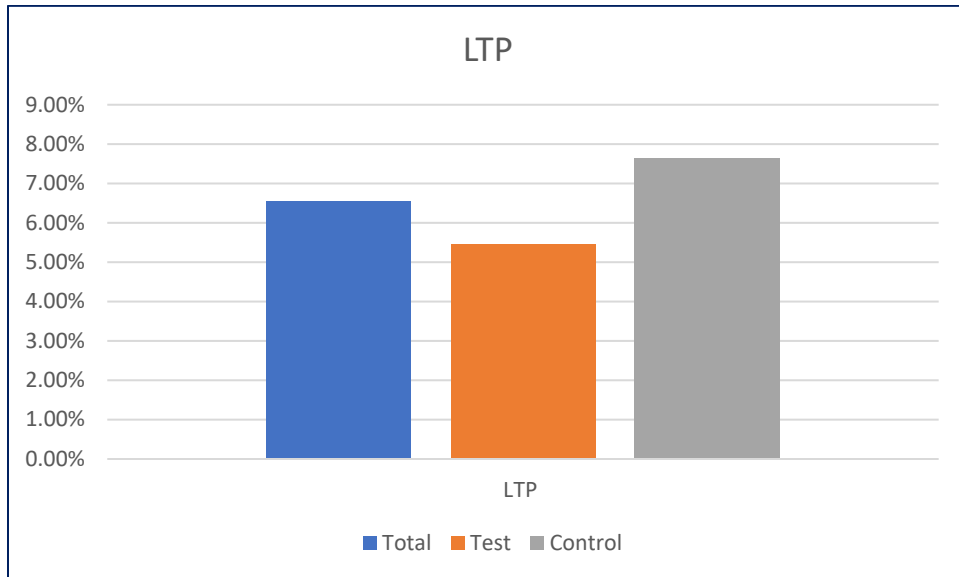
- Even when sectoral performance remains same, the overall returns of a diversified mutual fund can dip/spike owing to change in allocation percentages.
- The overall revenue numbers may increase/decrease, even when individual segments (given in problem 1) see reduced/increased defection owing to change in strength of the segments.

Section 2: Product Experiment Analysis

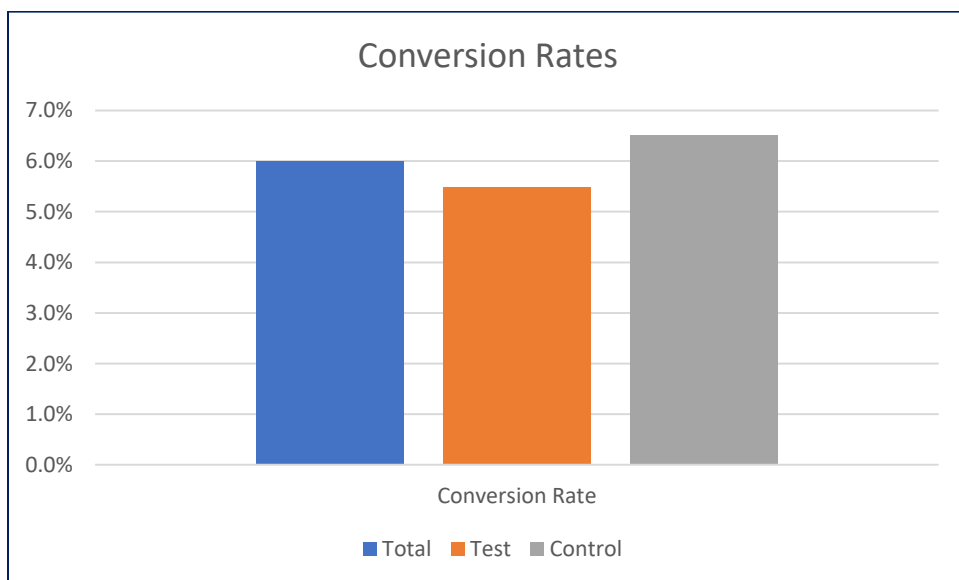
2.1. MS Excel was used to plot the charts. Clustered columns chart was chosen to aptly display the metrics.

(While going through data, it is observed that 3 unpaid users (303,1555,2221) have played cash games. By definition, cash games require users to make a deposit first, which makes them paid users.)

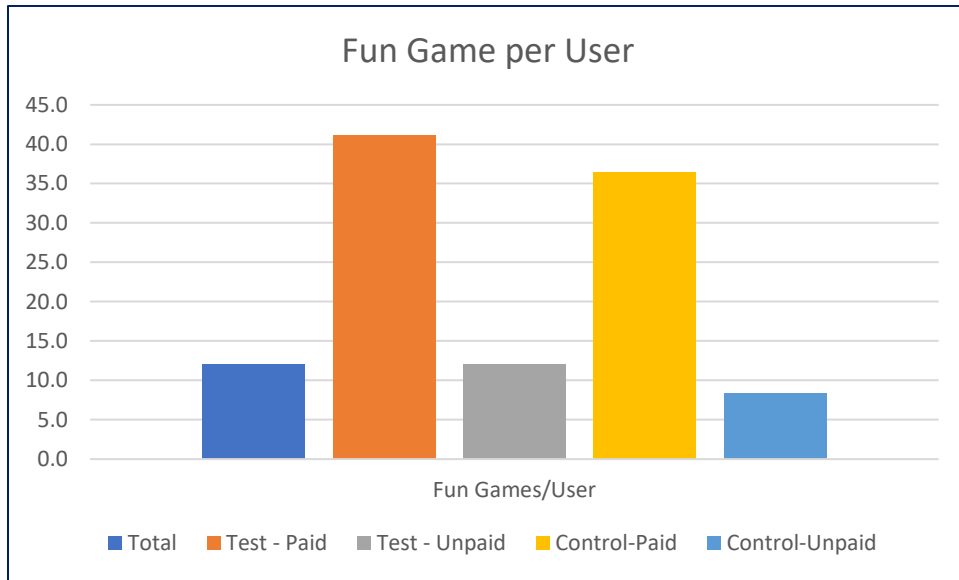
a.



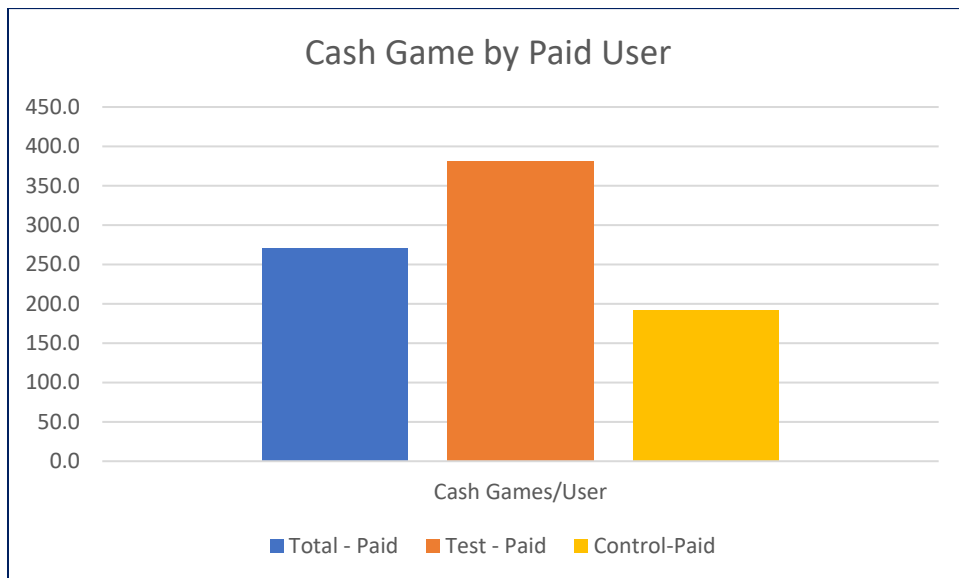
b. (Conversion rate for *test* group is higher than LTP because 2 unpaid users has played cash games in the test group)



c. Fun games is presented as #Fun games/user.



d.



(Cash games paid by unpaid users are ignored in the above chart)

2.2. The recommendation would be based on what the feature is and how the users are classified as *test* and *control*. There could be reluctance for existing users to adopt a new feature or on the other hand, users may adopt new feature with extra zeal in the initial days which will eventually wear out. These are ignored in the recommendation below.

Recommendation

Revenue per user (Test) = 45.6

Revenue per user (Control) = 50.8

This might suggest that we should not go ahead with the new feature.

However, we can see that in terms of cash games played, *test* group of paid users is well ahead of *control* group of paid users. Even after discounting for the difference in conversion rate and LTP, test group still wins in terms of cash games.

So, essentially, new feature seems to be resulting in a greater number of cash games, but lower revenues. We need to understand if this is because the test users are winning more or because test users are betting less. The final recommendation may be based on this data point.

2.3 A/B testing

The null hypothesis is that there is no difference between test group and the control group. 2-tailed test is employed.

LTP

Control group LTP = 7.65% : a

Test group LTP = 5.44% : b

Relative change = -28.82% : $c = (b-a)/a$

Standard error of control group = 0.004866 : $d = (a*(1-a)/\text{count of ctrl group})^{0.5}$

Standard error of test group = 0.004184 : $e = (b*(1-b)/\text{count of test group})^{0.5}$

Std. Error of difference = 0.006417 : $f = (d^2 + e^2)^{0.5}$

Z score = -3.43 : $g = (b-a)/f$

The high (absolute value) z score indicates the result is **significant at 99% confidence level**. The LTP for **test group is significantly lower in comparison to control group**.

Conversion rate

Control group conversion rate = 6.5%

Test group conversion rate = 5.5 %

Relative change = -15.82%

Standard error of control group = 0.004516

Standard error of test group = 0.004196

Std. Error of difference = 0.006165

Z score = -1.67, p = 0.0475

The low score of z indicates the result is **not significant at 95% confidence level**. However, the test is **significant at 90% levels**.

Fun Games (2 sample t-test)

t-Test: Two-Sample Assuming Unequal Variances		
	<i>Control</i>	<i>Test</i>
Mean	10.46814219	13.62075
Variance	2012.126291	15031.65

Observations	2982	2940
Hypothesized Mean Difference	0	
df	3702	
t Stat	-1.310454221	
P(T<=t) one-tail	0.095061758	
t Critical one-tail	1.645265338	
P(T<=t) two-tail	0.190123517	
t Critical two-tail	1.960604999	

Going for a 2 tailed test, we can see that p value is 0.19. **Hence the test is not significant at 95%. (However, test is significant at 80%). We cannot reject null hypothesis (both test group and control group perform in a similar manner)**

Cash Games (2 sample t-test)

t-Test: Two-Sample Assuming Unequal Variances		
	<i>Control</i>	<i>Test</i>
Mean	14.70623742	20.73979592
Variance	9541.894889	18092.70975
Observations	2982	2940
Hypothesized Mean Difference	0	
df	5361	
t Stat	-1.97278235	
P(T<=t) one-tail	0.024285832	
t Critical one-tail	1.645137909	
P(T<=t) two-tail	0.048571664	
t Critical two-tail	1.960406588	

Going for the 2-tailed test, **we can reject null hypothesis at 95% confidence levels. The average number of cash games is higher for the test group.**

Section 3: Allocation of marketing spent.

The problem is solved using LP in Excel.

$$\text{Maximize } Z = \text{AN}_R + \text{FB}_R + \text{GD}_R + \text{GS}_R + \text{ORG}_R$$

Subject to constraints in budget and the maximum clicks/impressions.

Assumptions

- Google search is not affecting WoM
- Effect of AppNexus on organic traffic is not significant at 95% significance level. However, it is significant at 90% confidence level. Therefore separate LP formulations are done for both cases, yielding different results.

Case 1 – Effect of AppNexus ignored on organic registration.

Facebook Spend	G. Search Spend	G. Display Spend	AppNex Spend	Email Spend
₹ 641,250	₹ 450,000	₹ 3,000,000	₹ 408,750	₹ 500,000

Case 2 – Effect of AppNexus on organic registration is not ignored.

Facebook Spend	G. Search Spend	G. Display Spend	AppNex Spend	Email Spend
₹ 641,250	₹ -	₹ 1,808,750	₹ 2,050,000	₹ 500,000

The formulation is provided in next page.

Case 1: When ignoring the effect of AppNexus on organic registrations as contribution is not significant at 95%

		Facebook Spend	G. Search Spend	G. Display Spend	AN spend	Email Spend	Total	Constraints
	Decision variables	641250	450000	3000000	408750	500000		
	Contribution ratio	0.005507719	0.000178667	0.004451533	2.57561E-05	0.056472	45213.3528	
	Contribution	3531.825	80.4	13354.6	10.52780488	28236		
Constraints	FB clicks	0.035087719	0	0	0	0	22500	22,500
	G.Search clicks	0	0.055555556	0	0	0	25000	25,000
	G.Display Clicks	0	0	0.066666667	0	0	200000	200,000
	AN Clicks	0	0	0	0.048780488	0	19939.02439	100,000
	Emails	0	0	0	0	20	10000000	10,000,000
	Total Spend	1	1	1	1	1	5000000	5,000,000

Case 2: When including the effect of AppNexus on organic registrations even though contribution is not significant at 95%

		Facebook Spend	G. Search Spend	G. Display Spend	AN spend	Email Spend	Total	Constraints
	Decision variables	641250	0	1808750	2050000	500000		
	Contribution ratio	0.005507719	0.000178667	0.004451533	0.005713756	0.056472	51532.73592	
	Contribution	3531.825	0	8051.710917	11713.2	28236		
Constraints	FB clicks	0.035087719	0	0	0	0	22500	22,500
	G.Search clicks	0	0.055555556	0	0	0	0	25,000
	G.Display Clicks	0	0	0.066666667	0	0	120583.3333	200,000
	AN Clicks	0	0	0	0.048780488	0	100000	100,000
	Emails	0	0	0	0	20	10000000	10,000,000
	Total Spend	1	1	1	1	1	5000000	5,000,000