

Executive Summary

Objective:

We intend to maximize Smart Partyware's profit by using data analytics techniques along with direct marketing by selecting a group of 100,000 customers with the highest propensity to purchase the party package. The baseline profit given that the party package is mailed out randomly is $= (100,000) * 0.112 * (\$60 - 10 - 4.5) + (100,000) * .888 * (\$ - 4) = \$154,000$. The goal is to maximize sales profit

JMP Model:

In the JMP model we use the following variables:

- Gender
- R
- Birthday Party
- Art Party
- Block Party

Key Insights: The JMP model uses the variables that are going to have the most significant impact on the neural model and in turn help in increasing the profit margin. It is intuitive that people who are spending in birthday parties, Art parties and block parties are also likely to spend in Celebrating American Arts theme as well, hence justifying their inclusion in the model.

Your Best Model:

Our best model includes the following variables:

- Art party
- Recency
- Block party
- Gender
- Cooking Party
- End-of-School-Term Party
- Party Total

Key Changes Made:

We have increased the cut off probability to 0.18. Also, we have included extra variables such as the Sum of total parties, which took consideration of all the parties. In addition, we also included cooking party and end of school party and our intuition is supported by a significant increase in the profits.

Key Insights:

We believe that a person who is most likely to be buying products for different theme parties is most likely to buy the Celebrating American Arts theme as well. Also, someone who has bought the products recently is more likely to buy them because over time peoples choices and financial status change and hence, recency is a significant factor.

Why your model is better?

Our model is better because it increases the profit to \$1,302,250 as compared to the baseline profit of \$ 1,068,250.

JMP Model

Y = Success

X = Gender, R, Birthday Party, Art Party, Block Party

Cutoff Probability for mailing = 0.15

Lift Table in Dollars	Training	Testing
Lift with respect to Baseline - JMP Model	7.901554404	8.56865285
Lift with respect to Baseline - My Best Model	6.918717617	5.918031579
Lift with respect to JMP Model - My Contribution	0.875614754	0.748970554
Overall Lift with respect to Baseline -My Best Model	6.918717617	5.918031579

Lift Table in Propensity	Training	Testing
Lift with respect to Baseline - JMP Model	3.139717425	3.373015873
Lift with respect to Baseline - My Best Model	2.687682216	2.369668246

Neural

Validation: Excluded Rows

Model NTanH(3)NTanH2(6)

Training

Success	Measures
Generalized RSquare	0.2350764
Entropy RSquare	0.1798365
RMSE	0.2887148
Mean Abs Dev	0.1669114
Misclassification Rate	0.103
-LogLikelihood	287.61206
Sum Freq	1000

Validation**Success**

Generalized RSquare
Entropy RSquare
RMSE
Mean Abs Dev
Misclassification Rate
-LogLikelihood
Sum Freq

Measures

0.196121
0.1501372
0.2883384
0.1681379
0.104
285.49629
1000

Diagram

Gender

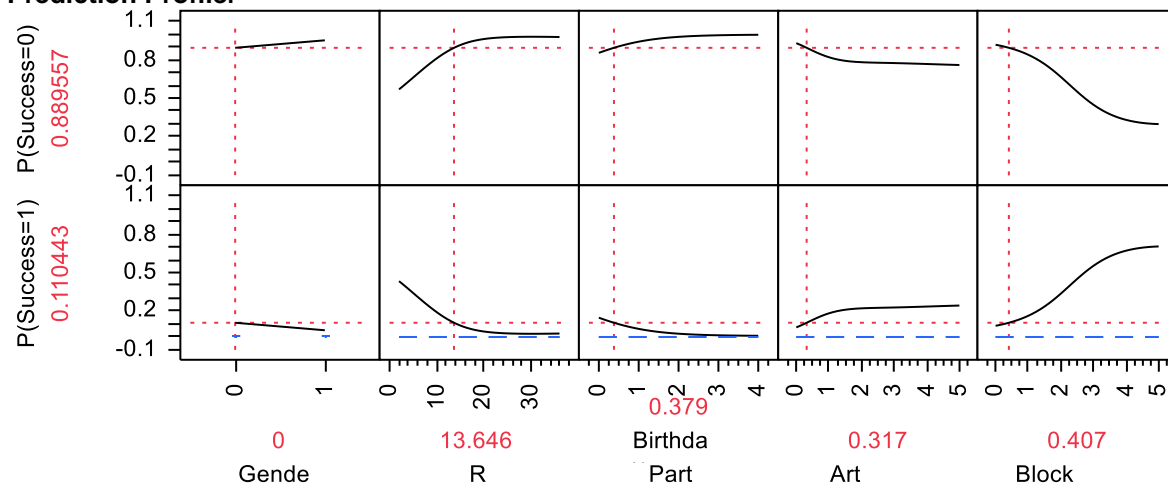
R

Birthday Party

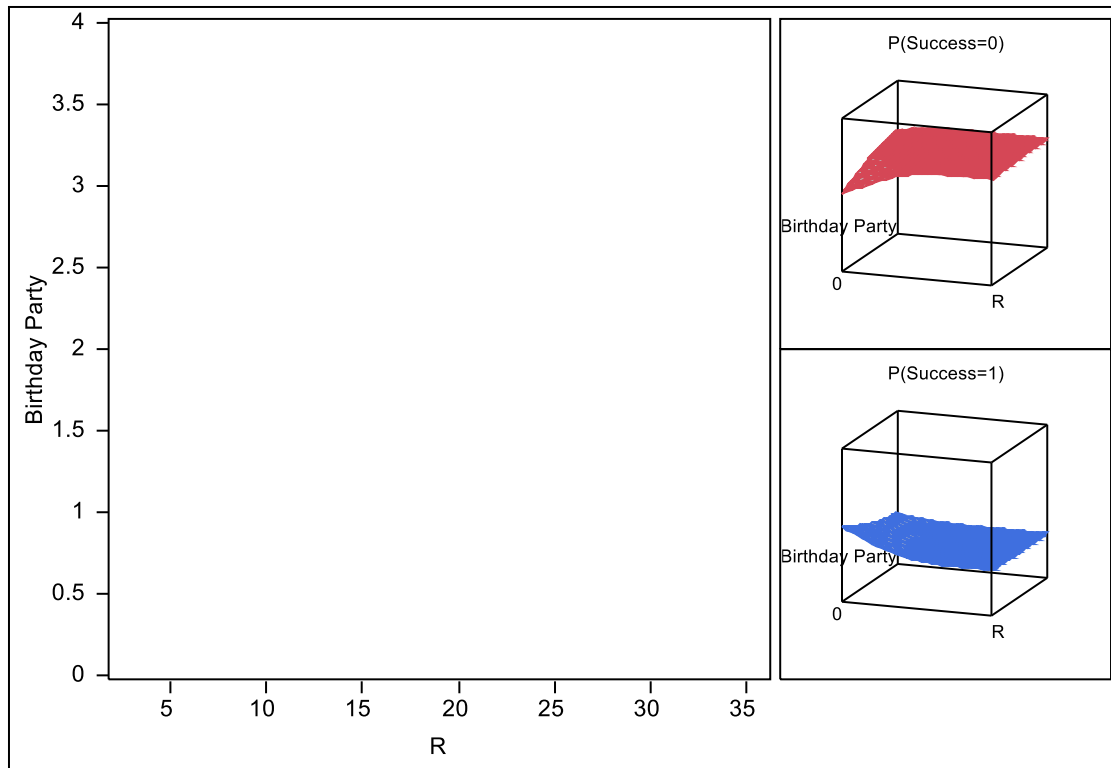
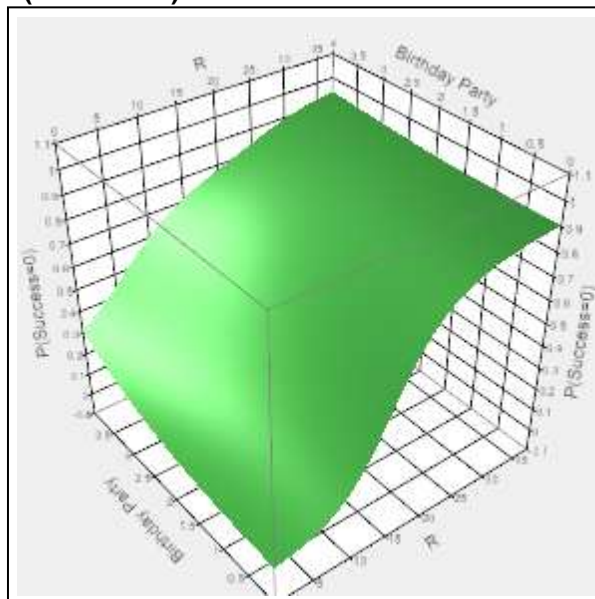
Art Party

Block Party

Success

Prediction Profiler**Contour Profiler**

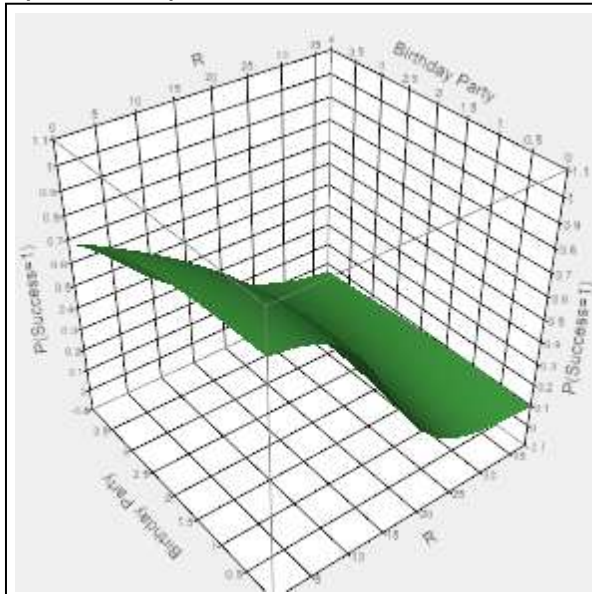
HorizVert	Factor	Current X		
	Gender	0	0	
	R	13.646		
	Birthday Party	0.379		
	Art Party	0.317		
	Block Party	0.407		
Response	Contour	Current Y	Lo Limit	Hi Limit
P(Success=0)	0.5	0.8895573	.	.
P(Success=1)	0.5	0.1104427	.	.

**P(Success=0)****Response Grid Slider**

0.5

Independent Variables

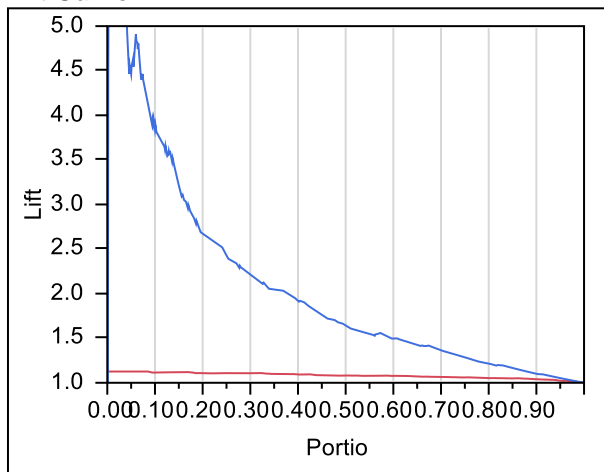
X	Y	Value	Grid
	Gender	0	
	R	19	
	Birthday Party	2	
	Art Party	2.5	
	Block Party	2.5	

P(Success=1)**Response Grid Slider**

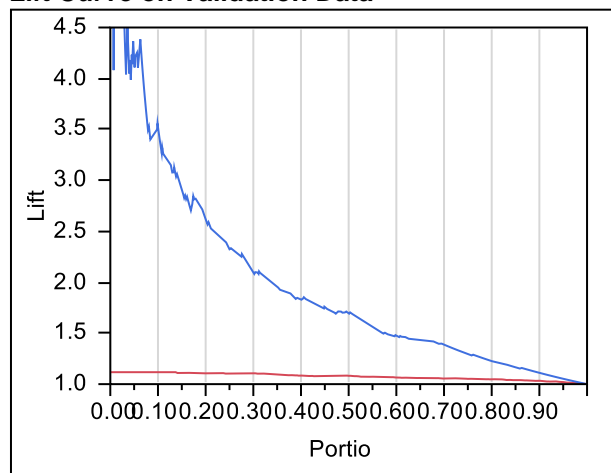
0.5

Independent Variables

X	Y	Value	Grid
	Gender	0	
	R	19	
	Birthday Party	2	
	Art Party	2.5	
	Block Party	2.5	

Lift Curve

Legend	Success
—	0
—	1

Lift Curve on Validation Data

Legend **Success**
 — 0
 — 1

Business KPIs of JMP Model – Training

Predicted number of Buyer	=	98000
Upper limit for packages sent	=	100000
Actual number of packages sent	=	98000

Propensity to buy the Package	=	30.102%
Propensity to not buy the Package	=	69.898%

Total Profit	=	\$1,068,250
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Accuracy %	81.00%
True Positive Rate	52.68%
False Positive Rate	15.43%
Sensitivity (True Positive Rate)	52.68%
Specificity (True Negative Rate)	84.57%

Business KPIs of JMP Model – Testing

Predicted number of Buyer	=	105500
Upper limit for packages sent	=	100000
Actual number of packages sent	=	100000

Propensity to buy the Package	=	26.540%
Propensity to not buy the Package	=	73.460%

Total Profit	=	\$913,744
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Accuracy %	79.60%
True Positive Rate	53.33%
False Positive Rate	17.32%
Sensitivity (True Positive Rate)	53.33%
Specificity (True Negative Rate)	82.68%

Confusion Matrix for Training

	Not Buyer	Buyer	
Not Buyer	751	137	888
Buyer	53	59	112
	804	196	1000

iv) Confusion Matrix for Testing

	Not Buyer	Buyer	
Not Buyer	740	155	895
Buyer	49	56	105
	789	211	1000

Interpret the Model (decision tree) – From Business Point of view & Statistical Point of view:

Our Best Model

Y = Success

X = Art party, Recency, Block party, Gender, Cooking Party, End-of-School-Term Party, Party Total

Cutoff Probability for mailing = 0.18

Neural

Model NTanH(7)

Training

Success

Measures	Value
Generalized RSquare	0.3075322
Entropy RSquare	0.2513695
RMSE	0.2699451

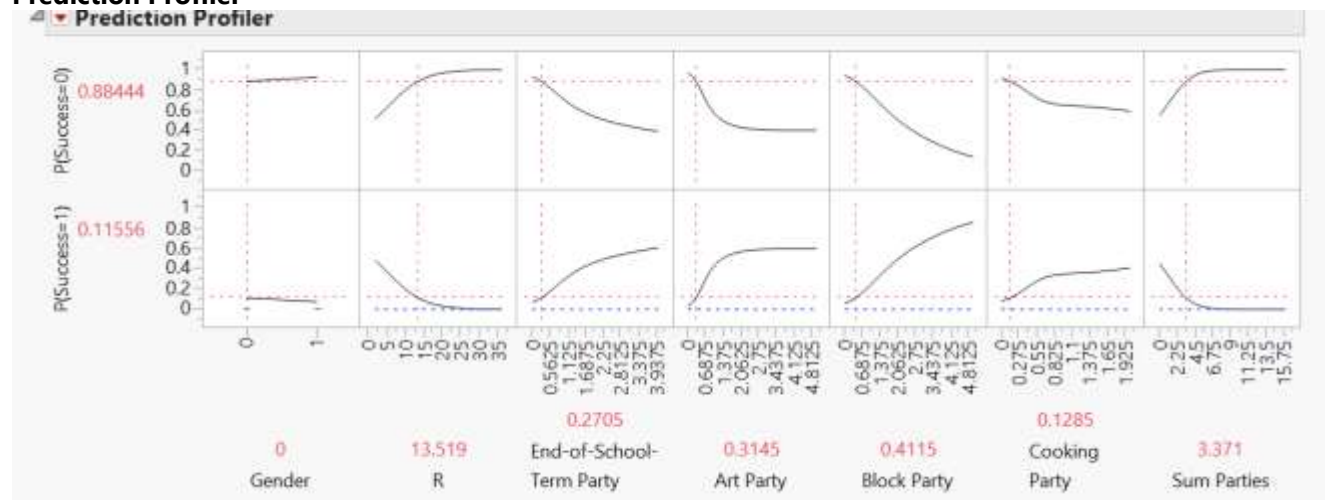
Measures	Value
Mean Abs Dev	0.1513306
Misclassification Rate	0.098731
-LogLikelihood	488.43359
Sum Freq	1000

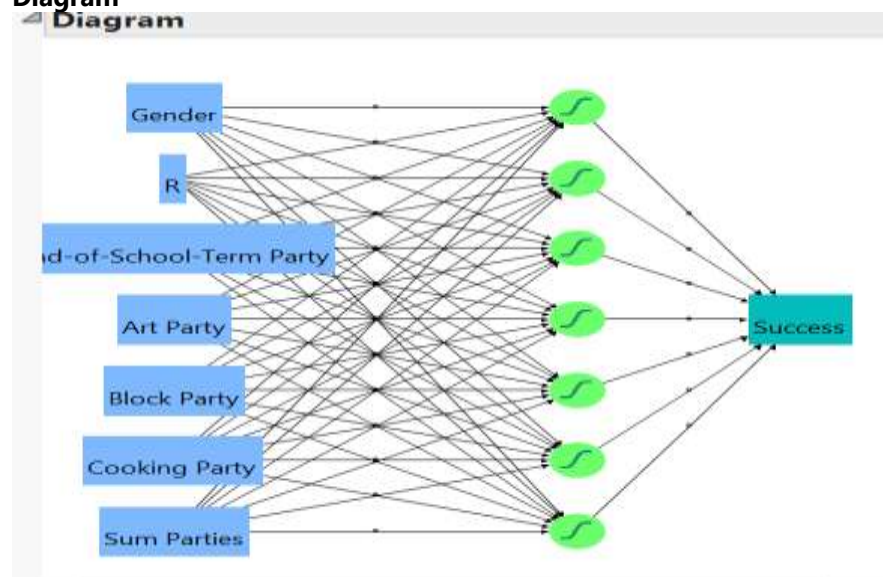
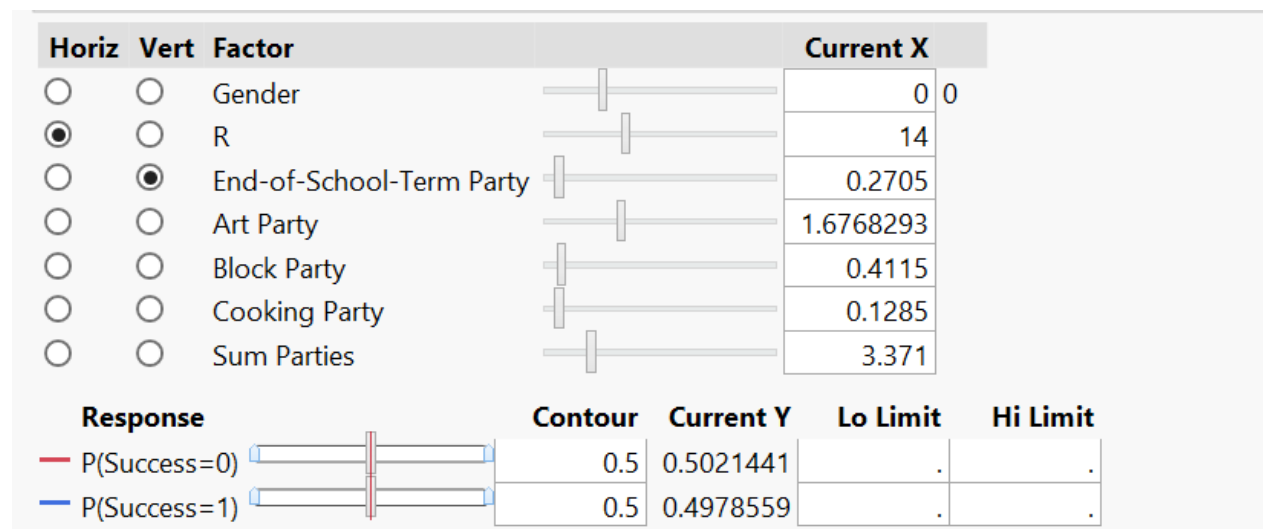
Validation

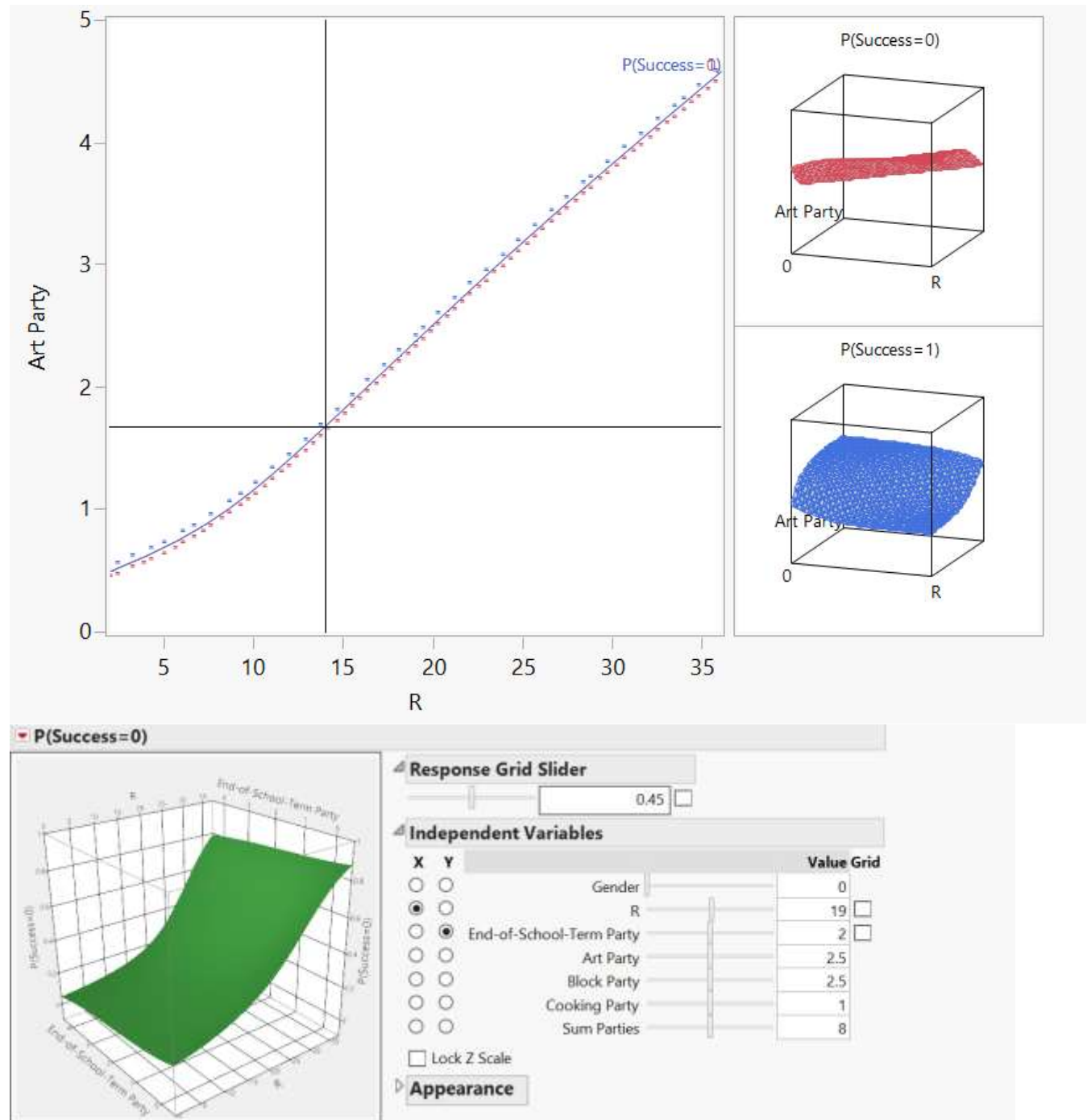
Success

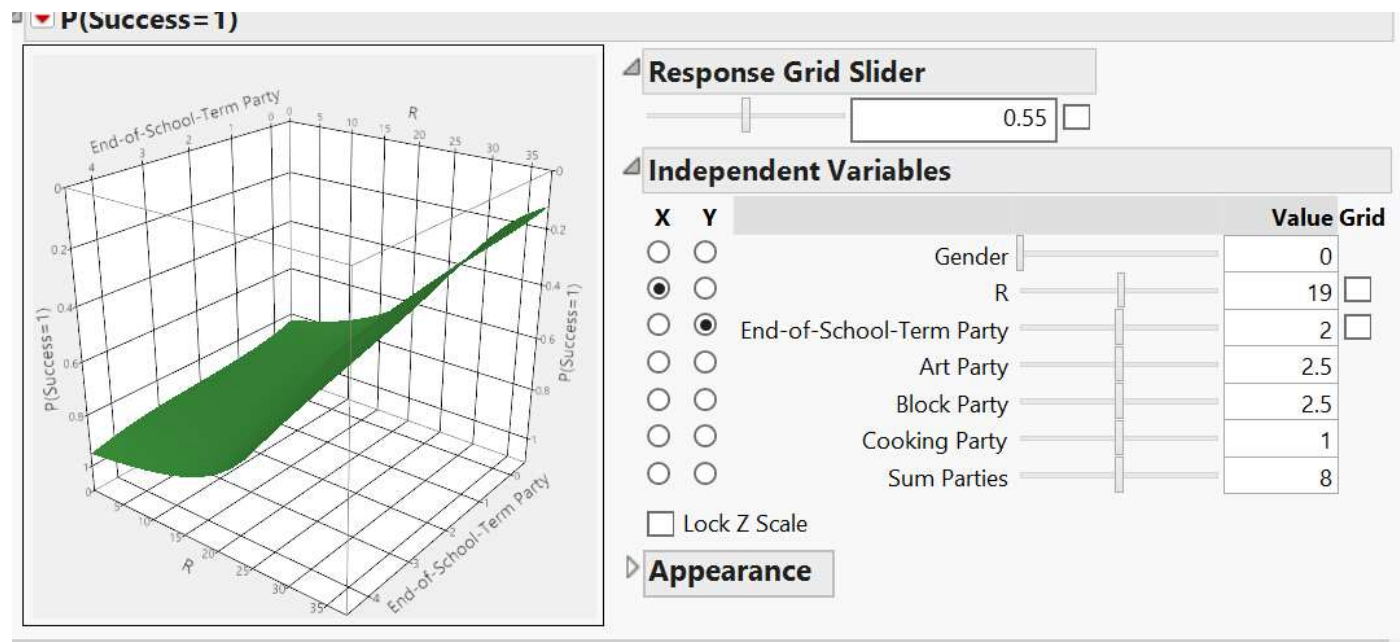
Measures	Value
Generalized RSquare	0.3801255
Entropy RSquare	0.3125793
RMSE	0.2583719
Mean Abs Dev	0.1483256
Misclassification Rate	0.0974214
-LogLikelihood	32.209025
Sum Freq	1000

Prediction Profiler

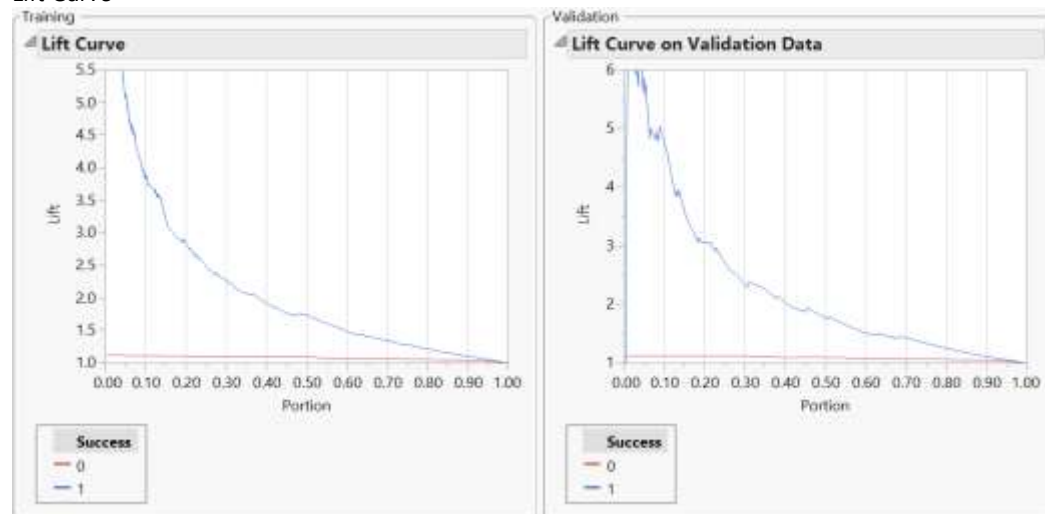


Diagram**Contour Profiler**





Lift Curve



Business KPIs of JMP Model – Training

Predicted number of Buyer	=	92500
Upper limit for packages sent	=	100000
Actual number of packages sent	=	92500

Propensity to buy the Package	=	35.135%
Propensity to not buy the Package	=	64.865%

Total Profit	=	\$ 1,238,750
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Other Metrics	
Accuracy %	83.30%
True Positive Rate	58.04%
False Positive Rate	13.51%
Sensitivity (True Positive Rate)	58.04%
Specificity (True Negative Rate)	86.49%

Business KPIs of JMP Model – Testing

Predicted number of Buyer	=	89000
Upper limit for packages sent	=	100000
Actual number of packages sent	=	89000

Propensity to buy the Package	=	37.640%
Propensity to not buy the Package	=	62.360%

Total Profit	=	\$ 1,302,250
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Other Metrics	
Accuracy %	85.10%
True Positive Rate	63.81%
False Positive Rate	12.40%
Sensitivity (True Positive Rate)	63.81%
Specificity (True Negative Rate)	87.60%

Confusion Matrix for Training

Confusion Matrix

		Predicted		
		Not Buyer	Buyer	
Actual	Not Buyer	768	120	888
	Buyer	47	65	112
		815	185	1000

iv) Confusion Matrix for Testing

Confusion Matrix

		Predicted		
		Not Buyer	Buyer	
Actual	Not Buyer	784	111	895
	Buyer	38	67	105
		822	168	1000

Lift Table in Dollars	Training	Testing
Lift with respect to Baseline - JMP Model	8.022992228	8.434261658
Lift with respect to Baseline - My Best Model	7.056425309	6.032356549
Lift with respect to JMP Model - My Contribution	0.885202391	0.754542396
Overall Lift with respect to Baseline -My Best Model	7.034357124	6.010032979

Lift Table in Propensity	Training	Testing
Lift with respect to Baseline - JMP Model	3.137065637	3.360754414
Lift with respect to Baseline - My Best Model	2.690219934	2.378341135

Interpret the Model (Neural Network) – From Business Point of view & Statistical Point of view:

Nominal Logistic Fit for Success

Converged in Gradient, 6 iterations

Whole Model Test

Model	-LogLikelihood	DF	ChiSquare	Prob>ChiSq
Difference	62.65902	7	125.318	<.0001*
Full	288.01748			
Reduced	350.67650			

RSquare (U)	0.1787
AICc	592.18
BIC	631.297
Observations (or Sum Wgts)	1000

Measure	Training Definition
Entropy RSquare	0.1787 $1 - \text{Loglike}(\text{model}) / \text{Loglike}(0)$
Generalized RSquare	0.2337 $(1 - (L(0)/L(\text{model}))^{(2/n)}) / (1 - L(0)^{(2/n)})$

Measure

Mean -Log p	0.2880 $\sum -\text{Log}(\rho[j])/n$
RMSE	0.2887 $\sqrt{\sum (y[j]-\rho[j])^2/n}$
Mean Abs Dev	0.1669 $\sum y[j]-\rho[j] /n$
Misclassification Rate	0.1030 $\sum (\rho[j] \neq \rho_{\text{Max}})/n$
N	1000 n

Training Definition**Lack Of Fit**

Source	DF	-LogLikelihood	ChiSquare
Lack Of Fit	505	165.34242	330.6848
Saturated	512	122.67506	Prob>ChiSq
Fitted	7	288.01748	1.0000

Parameter Estimates

Term	Estimate	Std Error	ChiSquare	Prob>ChiSq
Intercept	0.99137188	0.2135434	21.55	<.0001*
Gender[0]	-0.4125162	0.1140049	13.09	0.0003*
R	0.1154996	0.0186968	38.16	<.0001*
End-of-School-Term Party	-0.8982344	0.2211959	16.49	<.0001*
Art Party	-1.266923	0.2162387	34.33	<.0001*
Block Party	-0.9018015	0.1828816	24.32	<.0001*
Cooking Party	-0.8698818	0.3694966	5.54	0.0186*
Total Parties	0.29703062	0.0718525	17.09	<.0001*

For log odds of 0/1

Effect Likelihood Ratio Tests

Source	Nparm	DF	L-R ChiSquare	Prob>ChiSq
Gender	1	1	12.7029169	0.0004*
R	1	1	51.5744259	<.0001*
End-of-School-Term Party	1	1	16.4487598	<.0001*
Art Party	1	1	38.4420701	<.0001*
Block Party	1	1	26.4884288	<.0001*
Cooking Party	1	1	5.50844159	0.0189*
Total Parties	1	1	20.7004801	<.0001*