Question 1

1.a.

We would like to develop a beer product with five attributes: price, taste, ABV, packaging, and eco-friendliness. We are looking to test and market a beer based on its use of recycled materials, water conservation and renewable energy, a relatively new concept for the target audience. Different levels of the attributes are listed below. A copy of the questionnaire is attached in the appendix.

- Price: $4, $6, $8
- Taste: hoppy, malty, fruity, bitter
- ABV: 4%, 6%, 8%
- Packaging: can, bottle
- Eco-friendliness: no sustainable manufacturing practices, sustainable manufacturing practices

1.b.

Levels	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
Intercept	4.25	3.375	5.5	4.125	2.125	4.625	3.125	5	2.625	2.5
Price: $6	-1.125	-0.5	-0.5	-1.5	1.125	0.25	0.125	0.375	-0.375	-0.125
Price: $8	-0.125	5.45E-16	-0.75	-1.75	1.125	-0.25	-1.125	0.625	-0.875	-0.625
Taste: Malty	0.25	0.5	-1	0.25	1.5	-1.5	-0.5	-4.1E-16	1.25	1.5
Taste: Fruity	-1	2.25	-4	0.75	0.75	0.25	-2.25	-0.75	0.5	1.25
Taste: Bitter	-2	-1.25	-2.25	-0.25	-1.5	-1.75	-0.75	0.25	-1.5	-1
ABV: 6%	0.75	0.75	1	0.625	1.625	0.5	1.875	0.5	0.625	1.5
ABV: 8%	1.5	0.75	0.75	0.625	1.625	0.5	2.125	6.8E-17	1.125	0.25
Packaging: Bottle	0.875	0.25	-1.125	-0.625	0.625	1.87E-16	-1.6E-17	-2.25	0.125	0.875
Eco-Friendliness: Sustainable Manufacturing Practices	-0.375	-0.5	-0.125	-0.125	-0.625	0.25	1.25	-2.9E-17	-0.125	0.625

- Above are the results for the first ten respondents of our survey. From this data, we determined that preferences were relatively inconsistent. The utility from taste, price, and packaging varied depending on personal tastes; no levels within attributes were dominant. However, the group was consistent in their desire for higher ABV, but the difference between 6% to 8% was minimal. As for eco-friendliness, respondents were indifferent to the sustainable manufacturing practices of breweries. In fact, the majority showed that eco-friendliness actually decreased their enjoyment, although it might just be an overall insignificant factor of the beer-drinking experience.

1.c.

Part-worths	
Price: $4	0
Price: $6	0.125
Price: $8	-1.125
Taste: Hoppy	0
Taste: Malty	-0.5
Taste: Fruity	-2.25
Taste: Bitter	-0.75
ABV: 4%	0
ABV: 6%	1.875
ABV: 8%	2.125
Packaging: Can	0
Packaging: Bottle	-1.56125E-17
Eco-Friendliness: No susta	0
Eco-Friendliness: Sustaina	1.25

Percentage Importance		
	Importance	%Importance
Price	1.25	18%
Taste	2.25	33%
ABV	2.125	31%
Packaging	1.56125E-17	0%
Eco-Friendliness	1.25	18%

Best and Worst Product Profiles		
	Best Product	Worst Product
Price	$6	$8
Taste	Hoppy	Fruity
ABV	8%	4%
Packaging	Can	Bottle
Eco-Friendliness	Sustainable	Unsustainable

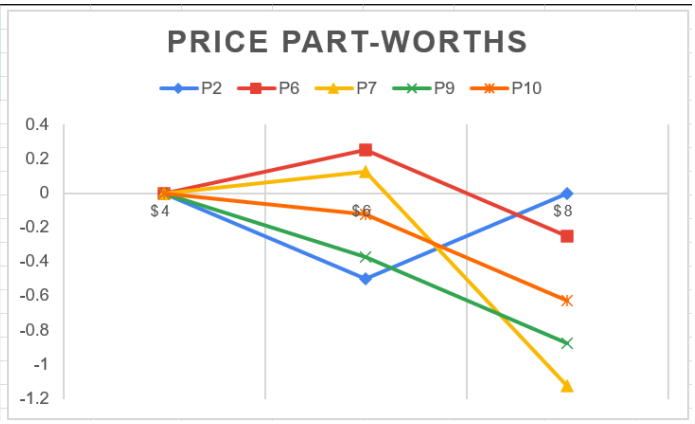
Utils to Dollars			
Price Range	Price Difference	Util Difference	Conversion ($/util)
$6 - $4	$2	0.125	$16.00
$8 - $6	$2	-1.25	($1.60)
		Average:	$7.20

Willingness-to-Pay (Relative to Baseline)	
Price: $4	-
Price: $6	$0.90
Price: $8	($8.10)
Taste: Hoppy	-
Taste: Malty	($3.60)
Taste: Fruity	($16.20)
Taste: Bitter	($5.40)
ABV: 4%	$0.00
ABV: 6%	$13.50
ABV: 8%	$15.30
Packaging: Can	-
Packaging: Bottle	($0.00)
Eco-Friendliness: No susta	-
Eco-Friendliness: Sustaina	$9.00

- The part-worths for Person 7 are shown on the left. Some general trends include:
    - Distaste for really cheap or really expensive beer
    - A preference towards hoppier beers as opposed to fruitier selections
    - The need for higher ABV beers to satisfy their cravings
    - A very slight preference towards canned beverages
    - An emphasis placed on the sustainability of their beer consumption
- In terms of importance, taste and ABV had the two highest ranges and were the most important (33% and 31% respectively). Price and eco-friendliness were equally as important (18%), but secondary in importance. Packaging was not important in the slightest.
- For the utils to dollar conversion, we decided to take an average of the two ranges because the "weird" result makes sense. The perception is that cheap beer is gross, which is why people get positive utility from the small increase in price. On the other hand, the quality of beer is almost indistinguishable from $6 to $8, so the jump in price is met with a decrease in utility. Because our average was positive: positive WTP = "I would pay… for this" and negative WTP = "You would have to pay me… for this".
- As a result, the best possible product is a sustainable $6 hoppy canned beer with 8% ABV. The worst is an unsustainable $8 fruity bottled beer with 4% ABV.

1.d.

Price	P2	P6	P7	P9	P10
$4	0	0	0	0	0
$6	-0.5	0.25	0.125	-0.375	-0.125
$8	5.45E-16	-0.25	-1.125	-0.875	-0.625



- Overall, increasingly higher prices yield relatively lower utilities. However, some people (P6, P7) might associate cheapness with low quality beer. They get more utility from slightly higher priced beer because they presume it will satisfy them more. Others (P2) might have expensive taste or only buy very high quality beer. Ultimately it depends on personal consumer tastes/budgets. And because beer is a relatively cheap product, price might not matter as much in decisions.

1.e.

- X: $6, malty, 8%, can, sustainable manufacturing practices
- Y: $8, fruity, 6%, bottle, no sustainable manufacturing practices
- Expected market share of X: 50%
- Expected market share of Y: 50%

1.f.

- The three additional product profiles are listed below. Based on our prior knowledge, we think product C will be the most promising given the moderate pricing and sustainable packaging.
    - A: $4, bitter, 8%, bottle, no sustainable manufacturing practices
    - B: $8, hoppy, 8%, can, sustainable manufacturing practices
    - C: $6, malty, 6%, can, sustainable manufacturing practices
- Expected market share (A, B, C, X, Y all present)
    - A: 1/10 = 10%
    - B: 2.5/10 = 25%
    - C: 2/10 = 20%
    - X: 2/10 = 20%
    - Y: 2.5/10 = 25%
- After calculation, the most promising products will be product B and product Y.

Question 2

A.

We believe the appropriate number of attitudinal segments for new car buyers is 5.
We ran the cluster analysis for multiple clusters (2,3,4,5,6,7) and found that the biggest change in total variance explained by the model was from 4-5 clusters, jumping from 51.7 % to 69.5 % (between_SS / total_SS), representing a change of 18%.
After this point it leveled off, with 6 clusters explaining 70.1 % and 7 clusters 70.4 % of between_SS / total_SS, which is a change of 0.6% and change of 0.03% respectively.
Adding more clusters doesn't meaningfully increase the shared variance explained by the model, so it doesn't help our interpretation. Therefore, 5 clusters fits our data the best for interpretability.

These are the mean differences in the response to each of the 17 questions across segments. The characteristics of attitudes toward buying a new car from the 5 different cluster groups of respondents are that:

```
Warning: non-uniform 'Rounding' sampler usedK-means clustering
with 5 clusters of sizes 96, 105, 93, 174, 356

Cluster means:
  Ideal_Price         Q1         Q2         Q3         Q4         Q5
1  -0.1017773  1.3406317  1.2395950  1.2456298  1.1998595  1.1018499
2  -0.1181660  1.0101322  1.1802134  1.2009713  1.1941954  1.2638077
3   2.2170207 -0.8643466 -0.8815210 -0.8791496 -0.9457474 -0.8623247
4   0.6919911  0.5957611  0.5705706  0.5710258  0.5941888  0.6002650
5  -0.8550880 -0.7248391 -0.7309589 -0.7395507 -0.7191331 -0.7379981
          Q6         Q7         Q8         Q9        Q10         Q11
1  1.1651172  1.2192228  1.2981589 -0.6338053 -0.3666297 -0.22193497
2  1.1538411  1.2066423  1.0869999 -0.3591967 -0.5836548 -0.67613224
3 -0.9739026 -0.9144071 -0.9175542  0.2311641  0.0699362  0.04931053
4  0.5886011  0.5917065  0.6132450  1.4764312  1.4515317  1.51836890
5 -0.6877759 -0.7349997 -0.7307032 -0.5051582 -0.4567146 -0.49573715
         Q12          Q13        Q14        Q15        Q16        Q17
1 -0.3070284 -0.35447779 -0.2913050 -0.2917893 -0.2854401  0.1925473
2 -0.7132132 -0.68365242 -0.6229041 -0.3025708 -0.3360262 -0.6589058
3  0.2393757  0.06706914  0.1945689  2.3174790  2.2969131  2.2745760
4  1.4736290  1.46834670  1.4556373 -0.3089989 -0.2750887 -0.3109696
5 -0.4896384 -0.43796737 -0.5000157 -0.2864552 -0.2895014 -0.2997929
```

Segment Description:

- Cluster 1: High (Q1-Q8), Low (Q9-Q14), Above Average Q17
- Cluster 2: High (Q1-Q8), Low (Q9-Q11), Very Low (Q12-Q14), Low (Q15-Q17)
- Cluster 3: Low (Q1-Q8), Above Average (Q9-Q14), Very High (Q15-Q17)
- Cluster 4: High (Q1-8), Very High (Q9-Q14), Low (Q15-Q17)
- Cluster 5: Low (Q1-Q8), Low (Q9-Q17)

Cluster 1 (96 respondents): High (Q1-Q8) These respondents prioritize the latest features, technology, smooth ride, easy handling, and high performance. Low (Q9-Q14): They show less interest in trendy designs, fashion consciousness, and using cars as fashion accessories. Above Average (Q17): They still value some degree of uniqueness or character in their cars.

Cluster 2 (105 respondents): High (Q1-Q8) Customers prioritize technology and performance. Low (Q9-Q11) means they have less interest in trendy designs. Very Low (Q12-Q14): They particularly show minimal interest in cars as extensions of themselves or fashion statements. Low (Q15-Q17): Consumers also have lower preferences for domestic origin, cult followings, or cars with character.

Cluster 3 (93 respondents): Low (Q1-Q8) These respondents don't prioritize technology and performance as much. Above Average (Q9-Q14), customers highly value trendy designs, fashion consciousness, and cars as fashion accessories. Very High (Q15-Q17) customers have a strong preference for domestic origin, cult followings, and cars with character.

Cluster 4 (174 respondents): High (Q1-Q8): Like Clusters 1 and 2, they prioritize technology, quality, and performance. Very High (Q9-Q14): They show very high interest in trendy designs, fashion consciousness, and cars as extensions of themselves or fashion statements. Low (Q15-Q17): Their interest in domestic origin, cult followings, and cars with character is comparatively lower.

Cluster 5 (356 respondents): Low (Q1-Q8), Low (Q9-Q17) On average, people in cluster 5 are below the mean for most questions related to car preferences. This means that they tend to disagree with the statements in the survey.

B.

Cluster 1: Tech-Savvy Performers:
Cutting-edge automotive technology and high-performance features are something this consumer prioritizes in their car and they desire smooth rides with easy handling. There is also a small degree of individuality in their vehicle.

Cluster 2: Modern Tech Aficionados:
Similar to cluster 1, these customers focus on technological advancements and performance capabilities and they also like a moderate interest in style and fashion, which differs from cluster one. Cluster two wants smooth rides and advanced features, focusing more on the technology side over the aesthetics.

Cluster 3: Fashionable Trendsetters:
Customers who want trendy designs and see their cars as a fashion accessory fits this category. They do not value the technological advancements or performance and rather value style and the domestic origin, whilst seeking a car that matches their personality.

Cluster 4: Premium Style Innovators:
These consumers seek the best technology, quality and style in their car. These customers are interested in trendy designs and fashion, whilst also matching the customers personality. These customers are not interested in the domestic origin or cult followings.

Cluster 5: Independent Outsiders: Customers do not like any of the questions, hence they are disinterested in the car industry. Driving a car could just be for transportation, with little emotional attachment to the car.

C.

```
                        PC1  PC2  PC3  PC4  PC5  PC6  PC7  PC8  PC9 PC10
SS loadings            7.03 3.80 1.83 0.42 0.41 0.39 0.38 0.36 0.33 0.31
Proportion Var         0.41 0.22 0.11 0.02 0.02 0.02 0.02 0.02 0.02 0.02
Cumulative Var         0.41 0.64 0.75 0.77 0.79 0.82 0.84 0.86 0.88 0.90
Proportion Explained   0.41 0.22 0.11 0.02 0.02 0.02 0.02 0.02 0.02 0.02
Cumulative Proportion  0.41 0.64 0.75 0.77 0.79 0.82 0.84 0.86 0.88 0.90
                       PC11 PC12 PC13 PC14 PC15 PC16 PC17
SS loadings            0.28 0.27 0.26 0.25 0.24 0.23 0.22
Proportion Var         0.02 0.02 0.02 0.01 0.01 0.01 0.01
Cumulative Var         0.91 0.93 0.94 0.96 0.97 0.99 1.00
Proportion Explained   0.02 0.02 0.02 0.01 0.01 0.01 0.01
Cumulative Proportion  0.91 0.93 0.94 0.96 0.97 0.99 1.00

Mean item complexity =  2.6
Test of the hypothesis that 17 components are sufficient.

The root mean square of the residuals (RMSR) is  0
 with the empirical chi square  0  with prob <  NA
```

From using the principle component analysis of the 17 questions that the respondents answered, there are 3 factors that we would choose. This is because the ss loadings show that PC1, PC2, PC3 are greater than one, and the next additional principal component is 0.42, which is lower than one. Using the other variables, proportion var, cumulative var, proportion explained and cumulative proportion, there weren't any principal components that had a significant change when going between PC3 to PC4, therefore we decided to stick with 3 factors.

	RC1 <S3: AsIs>	RC2 <S3: AsIs>	RC3 <S3: AsIs>	h2 <dbl>	u2 <dbl>	com <dbl>
Ideal_Price	0.15	0.48	0.82	0.9170089	0.0829911	1.686088
Q1	0.86	0.12	-0.08	0.7618765	0.2381235	1.054864
Q2	0.87	0.11	-0.09	0.7776150	0.2223850	1.054909
Q3	0.87	0.10	-0.09	0.7812556	0.2187444	1.050044
Q4	0.87	0.11	-0.11	0.7864185	0.2135815	1.066286
Q5	0.87	0.11	-0.08	0.7767152	0.2232848	1.048261
Q6	0.85	0.11	-0.13	0.7567122	0.2432878	1.079572
Q7	0.88	0.11	-0.10	0.7886091	0.2113909	1.056189
Q8	0.87	0.12	-0.10	0.7783589	0.2216411	1.069089
Q9	0.12	0.82	0.09	0.6986978	0.3013022	1.063327

Q10	0.10	0.81	0.02	0.6692631	0.3307369	1.032885
Q11	0.13	0.82	0.03	0.6969765	0.3030235	1.054505
Q12	0.09	0.82	0.08	0.6827615	0.3172385	1.041777
Q13	0.08	0.82	0.02	0.6796766	0.3203234	1.021823
Q14	0.12	0.82	0.07	0.6838500	0.3161500	1.057152
Q15	-0.22	0.02	0.85	0.7775989	0.2224011	1.127118
Q16	-0.21	0.03	0.85	0.7722420	0.2277580	1.129380
Q17	-0.19	0.00	0.86	0.7673464	0.2326536	1.095178

Factor 1: Q1-Q8 Range is the highest at RC1, which ranges from 0.88 to 0.85. Q1-Q8 has very low RC2, with the ranges between 0.12 and 0.10. There is also low RC3, with the ranges being negative from -0.08 to -0.13.

Factor 2: Q9-Q14 Range has a low RC1 from 0.13 to 0.09, high RC2 values ranging from 0.81 to 0.82 and finally a low RC3 values from 0.09 to 0.02.

Factor 3: Q15-Q17 Range is low for RC1 between -0.19 to -0.22 and this is negative. There is also a low RC2 ranging from 0.03 to 0.00 and lastly a high RC3 value from 0.86 to 0.85.

D.

Cluster 1: Tech-Savvy Performers

From parts a and b, we found out that consumers prioritize cutting-edge technology and high-performance features in their new car purchases. They also wanted smooth rides and easy handling, with some character in their vehicle choice.

This aligns with their high scores on Factor 1, indicating a preference for technology and performance, and their above-average score on Factor 3, suggesting some appreciation for individuality or uniqueness.

Cluster 2: Modern Tech Aficionados

Similar to Cluster 1, these consumers prioritize technology and performance but show less interest in trendy designs and fashion consciousness. They maintain moderate preferences for style and domestic origin. This is indicated by their scores on Factor 1 and Factor 3.

Cluster 3: Fashionable Trendsetters

This segment highly values trendy designs and fashion consciousness, viewing their cars as fashion accessories. While they may not prioritize technology and performance as much, they show a strong preference for domestic origin and cars with character. This aligns with their above-average scores on Factor 2 and Factor 3.

Cluster 4: Premium Style Innovators

Consumers in this segment seek the pinnacle of technology, quality, and style in their cars. They prioritize trendy designs and fashion consciousness, viewing their cars as extensions of themselves. However, their interest in domestic origin or cult followings may be relatively lower. This aligns with their low scores on Factor 3.

Cluster 5: Independent Outsiders

Respondents in this cluster exhibit scores below the mean across all car preference questions, suggesting a disinterest in the automotive industry. They prioritize neither technology nor fashion, and their preferences do not align with any specific segment identified through the clustering analysis.

Appendix

Questionnaire:

Beer Preferences

Rate the beer profile on a scale from 1 (Very Unfavorable) to 7 (Very Favorable)

1. Profile 1:

   Price: $4
   Taste: Malty
   ABV: 8%
   Packaging: Can
   Eco-friendliness: Sustainable manufacturing practices

   Mark only one oval.

	1	2	3	4	5	6	7	
Very	◯	◯	◯	◯	◯	◯	◯	Very Favorable

2. Profile 2:

   Price: $6
   Taste: Hoppy
   ABV: 4%
   Packaging: Bottle
   Eco-friendliness: Sustainable manufacturing practices

   Mark only one oval.

	1	2	3	4	5	6	7	
Very	◯	◯	◯	◯	◯	◯	◯	Very Favorable

3. Profile 3:

Price: $4
Taste: Malty
ABV: 4%
Packaging: Bottle
Eco-friendliness: No sustainable manufacturing practices

Mark only one oval.

	1	2	3	4	5	6	7	
Very	◯	◯	◯	◯	◯	◯	◯	Very Favorable

4. Profile 4:

Price: $8
Taste: Fruity
ABV: 4%
Packaging: Can
Eco-friendliness: Sustainable manufacturing practices

Mark only one oval.

	1	2	3	4	5	6	7	
Very	◯	◯	◯	◯	◯	◯	◯	Very Favorable

5. Profile 5:

Price: $6
Taste: Fruity
ABV: 8%
Packaging: Bottle
Eco-friendliness: No sustainable manufacturing practices

Mark only one oval.

	1	2	3	4	5	6	7	
Very	◯	◯	◯	◯	◯	◯	◯	Very Favorable

6. Profile 6:

Price: $8
Taste: Hoppy
ABV: 8%
Packaging: Can
Eco-friendliness: No sustainable manufacturing practices

Mark only one oval.

	1	2	3	4	5	6	7	
Very	◯	◯	◯	◯	◯	◯	◯	Very Favorable

7. Profile 7:

Price: $6
Taste: Malty
ABV: 6%
Packaging: Can
Eco-friendliness: Sustainable manufacturing practices

Mark only one oval.

	1	2	3	4	5	6	7	
Very	◯	◯	◯	◯	◯	◯	◯	Very Favorable

8. Profile 8:

Price: $4
Taste: Hoppy
ABV: 6%
Packaging: Can
Eco-friendliness: No sustainable manufacturing practices

Mark only one oval.

	1	2	3	4	5	6	7	
Very	◯	◯	◯	◯	◯	◯	◯	Very Favorable

9. Profile 9:

Price: $6
Taste: Bitter
ABV: 4%
Packaging: Can
Eco-friendliness: No sustainable manufacturing practices

Mark only one oval.

	1	2	3	4	5	6	7	
Very	◯	◯	◯	◯	◯	◯	◯	Very Favorable

10. Profile 10:

Price: $4
Taste: Bitter
ABV: 8%
Packaging: Bottle
Eco-friendliness: Sustainable manufacturing practices

Mark only one oval.

	1	2	3	4	5	6	7	
Very	◯	◯	◯	◯	◯	◯	◯	Very Favorable

11. Profile 11:

Price: $4
Taste: Fruity
ABV: 4%
Packaging: Can
Eco-friendliness: Sustainable manufacturing practices

Mark only one oval.

	1	2	3	4	5	6	7	
Very	◯	◯	◯	◯	◯	◯	◯	Very Favorable

12. Profile 12:

Price: $4
Taste: Fruity
ABV: 6%
Packaging: Bottle
Eco-friendliness: No sustainable manufacturing practices

Mark only one oval.

	1	2	3	4	5	6	7	
Very	◯	◯	◯	◯	◯	◯	◯	Very Favorable

13. Profile 13:

Price: $8
Taste: Bitter
ABV: 6%
Packaging: Bottle
Eco-friendliness: Sustainable manufacturing practices

Mark only one oval.

	1	2	3	4	5	6	7	
Very	◯	◯	◯	◯	◯	◯	◯	Very Favorable

14. Profile 14:

Price: $4
Taste: Hoppy
ABV: 4%
Packaging: Bottle
Eco-friendliness: Sustainable manufacturing practices

Mark only one oval.

	1	2	3	4	5	6	7	
Very	◯	◯	◯	◯	◯	◯	◯	Very Favorable

15. Profile 15:

Price: $4
Taste: Bitter
ABV: 4%
Packaging: Can
Eco-friendliness: No sustainable manufacturing practices

Mark only one oval.

	1	2	3	4	5	6	7	
Very	◯	◯	◯	◯	◯	◯	◯	Very Favorable

16. Profile 16:

Price: $8
Taste: Malty
ABV: 4%
Packaging: Bottle
Eco-friendliness: No sustainable manufacturing practices

Mark only one oval.

	1	2	3	4	5	6	7	
Very	◯	◯	◯	◯	◯	◯	◯	Very Favorable

1.b.:

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.974518
R Square	0.949686
Adjusted R Square	0.874214
Standard Error	0.57735
Observations	16

ANOVA

	df	*SS*	*MS*	*F*	*ignificance F*
Regression	9	37.75	4.194444	12.58333	0.002986
Residual	6	2	0.333333		
Total	15	39.75			

	Coefficients	*tandard Err*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*pper 95.0%*
Intercept	3.125	0.408248	7.654655	0.00026	2.126052	4.123948	2.126052	4.123948
Price: $6	0.125	0.353553	0.353553	0.735765	-0.74011	0.990114	-0.74011	0.990114
Price: $8	-1.125	0.353553	-3.18198	0.019028	-1.99011	-0.25989	-1.99011	-0.25989
Taste: Malty	-0.5	0.408248	-1.22474	0.26657	-1.49895	0.498948	-1.49895	0.498948
Taste: Fruity	-2.25	0.408248	-5.51135	0.001499	-3.24895	-1.25105	-3.24895	-1.25105
Taste: Bitter	-0.75	0.408248	-1.83712	0.11584	-1.74895	0.248948	-1.74895	0.248948
ABV: 6%	1.875	0.353553	5.303301	0.001824	1.009886	2.740114	1.009886	2.740114
ABV: 8%	2.125	0.353553	6.010408	0.000956	1.259886	2.990114	1.259886	2.990114
Packaging: Bottle	-1.6E-17	0.288675	-5.4E-17	1	-0.70636	0.706363	-0.70636	0.706363
Eco-Friendliness: Sustainable Manufacturing Practices	1.25	0.288675	4.330127	0.004928	0.543637	1.956363	0.543637	1.956363

- Above is the regression output for respondent 7. Person 7 was one of the respondents with the highest adjusted R square values: 87.4% of the variance in their ratings is explained by the indicator and dummy variables.

1.e.:

- X: $6, malty, 8%, can, sustainable manufacturing practices
- Y: $8, fruity, 6%, bottle, no sustainable manufacturing practices
- Baseline case: $4, hoppy, can, no sustainable manufacturing practices
    - Person 1: Y
        - Utility(X) = 4.25 - 1.125 + 0.25 + 1.5 + 0 - 0.375 = 4.5
        - Utility(Y) = 4.25 - 0.125 - 1 + 0.75 + 0.875 + 0 = 4.75
    - Person 2: Y
        - Utility(X) = 3.375 - 0.5 + 0.5 + 0.75 + 0 - 0.5 = 3.625
        - Utility(Y) = 3.375 + 5.45 * 10^(-16) + 2.25 + 0.75 + 0.25 + 0 = 6.625
    - Person 3: X
        - Utility(X) = 5.5 - 0.5 - 1 + 0.75 + 0 - 0.125 = 4.625
        - Utility(Y) = 5.5 - 0.75 - 4 + 1 - 1.125 + 0 = 0.625
    - Person 4: X
        - Utility(X) = 4.125 - 1.5 + 0.25 + 0.625 + 0 - 0.125 = 3.375
        - Utility(Y) = 4.125 - 1.75 + 0.75 + 0.625 - 0.625 + 0 = 3.125
    - Person 5: Y
        - Utility(X) = 2.125 + 1.125 + 1.5 + 1.625 + 0 - 0.625 = 5.75
        - Utility(Y) = 2.125 + 1.125 + 0.75 + 1.625 + 0.625 + 0 = 6.25
    - Person 6: Y
        - Utility(X) = 4.625 + 0.25 - 1.5 + 0.5 + 0 + 0.25 = 4.125
        - Utility(Y) = 4.625 - 0.25 + 0.25 + 0.5 + 1.87 * 10^(-16) + 0 = 5.125
    - Person 7: X
        - Utility(X) = 3.125 + 0.125 - 0.5 + 2.125 + 0 + 1.25 = 6.125
        - Utility(Y) = 3.125 - 1.125 - 2.25 + 1.875 - 1.6 * 10^(-17) + 0 = 1.625
    - Person 8: X
        - Utility(X) = 5 + 0.375 - 4.1 * 10^(-16) + 6.8 * 10^(-17) + 0 - 2.9 * 10^(-17) = 5.375
        - Utility(Y) = 5 + 0.625 - 0.75 + 0.5 - 2.25 + 0 = 3.125
    - Person 9: X
        - Utility(X) = 2.625 - 0.375 + 1.25 + 1.125 + 0 - 0.125 = 4.5
        - Utility(Y) = 2.625 - 0.875 + 0.5 + 0.625 + 0.125 + 0 = 3
    - Person 10: Y
        - Utility(X) = 2.5 - 0.125 + 1.5 + 0.25 + 0 + 0.625 = 4.75
        - Utility(Y) = 2.5 - 0.625 + 1.25 + 1.5 + 0.875 + 0 = 5.5
- Expected market share of X = 5/10 = 50%
- Expected market share of Y = 5/10 = 50%

1.f.:

- Baseline case: $4, hoppy, can, no sustainable manufacturing practices

- X: $6, malty, 8%, can, sustainable manufacturing practices
- Y: $8, fruity, 6%, bottle, no sustainable manufacturing practices
- A: $4, bitter, 8%, bottle, no sustainable manufacturing practices
- B: $8, hoppy, 8%, can, sustainable manufacturing practices
- C: $6, malty, 6%, can, sustainable manufacturing practices
- Person 1: B
    - Utility(X) = 4.25 - 1.125 + 0.25 + 1.5 + 0 - 0.375 = 4.5
    - Utility(Y) = 4.25 - 0.125 - 1 + 0.75 + 0.875 + 0 = 4.75
    - Utility(A) = 4.25 + 0 - 2 + 1.5 + 0.875 + 0 = 4.625
    - Utility(B) = 4.25 - 0.125 + 0 + 1.5 + 0 - 0.375 = 5.25
    - Utility(C) = 4.25 - 1.125 + 0.25 + 0.75 + 0 - 0.375 = 3.75
- Person 2: Y
    - Utility(X) = 3.375 - 0.5 + 0.5 + 0.75 + 0 - 0.5 = 3.625
    - Utility(Y) = 3.375 + 5.45 * 10^(-16) + 2.25 + 0.75 + 0.25 + 0 = 6.625
    - Utility(A) = 3.375 + 0 - 1.25 + 0.75 + 0.25 + 0 = 3.125
    - Utility(B) = 3.375 + 5.45*10^(-16) + 0 + 0.75 + 0 - 0.5 = 3.625
    - Utility(C) = 3.375 - 0.5 + 0.5 + 0.75 + 0 - 0.5 = 3.625
- Person 3: B
    - Utility(X) = 5.5 - 0.5 - 1 + 0.75 + 0 - 0.125 = 4.625
    - Utility(Y) = 5.5 - 0.75 - 4 + 1 - 1.125 + 0 = 0.625
    - Utility(A) = 5.5 + 0 - 2.25 + 0.75 - 1.125 + 0 = 2.875
    - Utility(B) = 5.5 - 0.75 + 0 + 0.75 + 0 - 0.125 = 5.375
    - Utility(C) = 5.5 - 0.5 - 1 + 1 + 0 - 0.125 = 4.875
- Person 4: A
    - Utility(X) = 4.125 - 1.5 + 0.25 + 0.625 + 0 - 0.125 = 3.375
    - Utility(Y) = 4.125 - 1.75 + 0.75 + 0.625 - 0.625 + 0 = 3.125
    - Utility(A) = 4.125 + 0 - 0.25 + 0.625 - 0.625 + 0 = 3.875
    - Utility(B) = 4.125 - 1.75 + 0 + 0.625 + 0 - 0.125 = 2.875
    - Utility(C) = 4.125 - 1.5 + 0.25 + 0.625 + 0 - 0.125 = 3.375
- Person 5: Y
    - Utility(X) = 2.125 + 1.125 + 1.5 + 1.625 + 0 - 0.625 = 5.75
    - Utility(Y) = 2.125 + 1.125 + 0.75 + 1.625 + 0.625 + 0 = 6.25
    - Utility(A) = 2.125 + 0 - 1.5 + 1.625 + 0.625 + 0 = 2.875
    - Utility(B) = 2.125 + 1.125 + 0 + 1.625 + 0 - 0.625 = 4.25
    - Utility(C) = 2.125 + 1.125 + 1.5 + 1.625 + 0 - 0.625 = 5.75
- Person 6: Y or B
    - Utility(X) = 4.625 + 0.25 - 1.5 + 0.5 + 0 + 0.25 = 4.125
    - Utility(Y) = 4.625 - 0.25 + 0.25 + 0.5 + 1.87 * 10^(-16) + 0 = 5.125
    - Utility(A) = 4.625 + 0 - 1.75 + 0.5 + 1.87*10^(-16) + 0 = 3.375
    - Utility(B) = 4.625 - 0.25 + 0 + 0.5 + 0 + 0.25 = 5.125
    - Utility(C) = 4.625 + 0.25 - 1.5 + 0.5 + 0 + 0.25 = 4.125
- Person 7: X
    - Utility(X) = 3.125 + 0.125 - 0.5 + 2.125 + 0 + 1.25 = 6.125
    - Utility(Y) = 3.125 - 1.125 - 2.25 + 1.875 - 1.6 * 10^(-17) + 0 = 1.625

    - Utility(A) = 3.125 + 0 - 0.75 + 2.125 - 1.6*10^(-17) + 0 = 4.5
    - Utility(B) = 3.125 - 1.125 + 0 + 2.125 + 0 + 1.25 = 5.375
    - Utility(C) = 3.125 + 0.125 - 0.5 +1.875 +0 +1.25 = 5.875
- Person 8: C
    - Utility(X) = 5 + 0.375 - 4.1 * 10^(-16) + 6.8 * 10^(-17) + 0 - 2.9 * 10^(-17) = 5.375
    - Utility(Y) = 5 + 0.625 - 0.75 + 0.5 - 2.25 + 0 = 3.125
    - Utility(A) = 5 + 0 + 0.25 + 6.8*10^(-17) - 2.25 + 0 = 3
    - Utility(B) = 5 + 0.625 + 0 + 6.8*10^(-17) + 0 - 2.9*10^(-17) = 5.625
    - Utility(C) = 5 + 0.375 - 4.1*10^(-16) + 0.5 + 0 - 2.9*10^(-17) = 5.875
- Person 9: X
    - Utility(X) = 2.625 - 0.375 + 1.25 + 1.125 + 0 - 0.125 = 4.5
    - Utility(Y) = 2.625 - 0.875 + 0.5 + 0.625 + 0.125 + 0 = 3
    - Utility(A) = 2.625 + 0 - 1.5 + 1.125 + 0.125 + 0 = 2.375
    - Utility(B) = 2.625 - 0.875 + 0 + 1.125 + 0 - 0.125 = 2.75
    - Utility(C) = 2.625 - 0.375 + 1.25 + 0.625 + 0 - 0.125 = 4
- Person 10: C
    - Utility(X) = 2.5 - 0.125 + 1.5 + 0.25 + 0 + 0.625 = 4.75
    - Utility(Y) = 2.5 - 0.625 + 1.25 + 1.5 + 0.875 + 0 = 5.5
    - Utility(A) = 2.5 + 0 - 1 + 0.25 + 0.875 + 0 = 2.625
    - Utility(B) = 2.5 - 0.625 + 0 + 0.25 + 0 + 0.625 = 2.75
    - Utility(C) = 2.5 - 0.125 + 1.5 + 1.5 + 0 + 0.625 = 6
- Expected market share (A, B, C, X, Y all present)
    - A: 1/10 = 10%
    - B: 2.5/10 = 25%
    - C: 2/10 = 20%
    - X: 2/10 = 20%
    - Y: 2.5/10 = 25%