Home Assignment: Individual

Conjoint Analysis

In this individual-based assignment, you need to work on two projects. Objective of the first project lies in the research design of a conjoint study for data collection. In contrast, the second project focuses on analyzing data collected in a conjoint study.

You are required to submit your answer to the email address of our TA, Mr. Frank Yuan by 11:00 p.m., April 12 (Thursday).

For tasks relying on data analyses with R, do not just copy R outputs as your answer without any interpretations. In a large sense, your clear-cut interpretations of the results based on solid and actionable marketing implications count more.

Before submitting your answer, compress all documents into a ".rar" or ".zip" file, named in this pattern: "Your Name-Your Student ID number.rar". For example, "Li_Kunlun-16210690140.rar" is the one that Mr. Li Kunlun (李昆仑) would submit. In the R script file that you submit to Frank, type in this command line on the top, "set.seed(last six digits of your student ID number)". For example, the first R command that Mr. Li Kunlun runs is `set.seed(690140)`. Make sure all the files that you submit are highly readable, clearly referred, and neatly organized into properly named and structured folders before the compressed file is attached to your email.

For technique issues or possible ambiguity in understanding the tasks in this assignment, you may contact Mr. Frank Yuan directly via email.

Be professional and good luck!

Project 1: Conjoint Experiment Design of Sport Cars

You are required to design a conjoint study of sport cars given the attributes and attribute levels displayed in **Table 1**.

Table 1: Attributes and attribute levels of sport cars

	Price	Brand	Horsepower	Upholstery	Sunroof
Levels	$23,000	Toyota	220HP	Cloth	Yes
	$25,000	Volkswagen	250HP	Leather	No
	$27,000	Saturn	280HP		
	$29,000	Kia			

You can use either R or SPSS to generate the orthogonal main effects design of product profiles used in the conjoint experiment.

Given these product profiles, use Qualtrics to develop a fully developed questionnaire to support a rating-based conjoint study of sport cars.

Your Tasks:

(1.1) You need to submit the product profiles generated in the orthogonal design. If you use R, export the design from R to a ".csv" file[1] and submit it, together with the R script file. If you use SPSS, provide the dataset (the ".sav" file) recording the design generated.

(1.2) Name the questionnaire that you design for this conjoint experiment as "Conjoint_Sport_Car-Your Name-Your Student ID number" in Qulatrics, and share it with Mr. Frank Yuan. For example, the questionnaire submitted by Mr. Li Kunlun for this task should be named as "Conjoint_Sport_Car-Li_Kunlun-16210690140". Our TA, Mr. Frank Yuan will share the conjoint study project on tablet computers that you've participated in with you on Qualtrics. You may take it as a reference for your design.

Besides, you need to provide the dummy dataset simulated by Qualtrics system. You may set a meaningful while small sample size, *e.g.*, 30 or 50. Export the data to a CSV file and submit it.

[1] For example, `write.csv2(roller.coaster.design.orthogonal, file = "Orthogonal Main Effects Plans.csv", row.names = TRUE)`

Project 2: Conjoint Analysis of HBAT

A company, HBAT, was seriously considering designing a new industrial cleanser for use in many manufacturing facilities. In developing the product concept, HBAT wanted a more thorough understanding of the needs and preferences of its industrial customers. Thus, in adjunction to a marketing research survey, HBAT commissioned a conjoint analysis experiment among 86 industrial customers.

Before the actual conjoint study was performed, internal marketing research teams, in consultation with the product development group, identified five factors as the determinant attributes in the targeted segment of the industrial cleanser market. The five attributes are shown in **Table 2**. Focus group research confirmed that these five attributes represented the primary determinants of value in an industrial cleanser for this segment, thus enabling the design phase to proceed with further specification of the attributes and their levels.

Table 2: Attributes and Levels for the HBAT Conjoint Analysis Experiment Involving Product Design of an Industrial Cleanser

Attribute Description	**Levels**		
Form of the Product	Premixed liquid	Concentrated liquid	Powder
Number of Applications per Container	50	100	200
Addition of Disinfectant	Yes	No	
Biodegradable Formulation	No	Yes	
Price per Typical Application	35 cents	49 cents	79 cents

Full-profile method has been selected for this conjoint study. With regard to the design of the profiles, the researcher takes great care in specifying the attribute levels to operationalize the attributes for use in design profiles. Among the considerations to be addressed are the nature of the levels (ensuring they are actionable and communicable), the magnitude and range of the levels for each attribute.

The first consideration was to ensure that each level was actionable and communicable. Focus group research established specific levels for each attribute (see **Table 2**). The levels were each designed to (1) employ terminology used in the industry and (2) represent aspects of the product routinely specified in buying decisions.

Three attributes of *Product Form*, *Disinfectant*, and *Biodegradability* only portrayed specific characteristics; two attributes needed further examination for appropriateness of the ranges of levels. First, *Number of Applications* ranged from 50 to 200. Given the product form selected, these levels were chosen to result in the typical types of product packaging found in industrial settings, ranging from small containers for individuals to larger containers normally associated with centralized maintenance operations. Next, the

three levels of *Price per Application* were determined from examining existing products. As such they were deemed to be realistic and to represent the most common price points in the current market.

For actual collection of preferences from respondents, HBAT decided to use the full-profile method of obtaining respondent evaluations. Researchers used a fractional factorial design to avoid the evaluation of all 108 possible combinations (3 × 3 × 2 × 2 × 3). The profile design component of the computer program generated a set of 18 full-profile descriptions (see **Table 3**), allowing for the estimation of the orthogonal main effects for each factor. Four additional profiles were generated to serve as the validation profiles. None of the profiles were deemed unacceptable after being reviewed for realism and appropriateness to the research question.

Table 3: Set of 22 Full-Profiles Used in the HBAT Conjoint Analysis Experiment for Designing an Industrial Cleanser

Profile #	*Level of Attributes*				
	Product Form	**Number of Applications**	**Disinfectant Quality**	**Biodegradable Form**	**Price per Application**
Profiles Used in Estimation of Part-Worths					
1	Concentrate	200	Yes	No	35 cents
2	Powder	200	Yes	No	35 cents
3	Premixed	100	Yes	Yes	49 cents
4	Powder	200	Yes	Yes	49 cents
5	Powder	50	Yes	No	79 cents
6	Concentrate	200	No	Yes	79 cents
7	Premixed	100	Yes	No	79 cents
8	Premixed	200	Yes	No	49 cents
9	Powder	100	No	No	49 cents
10	Concentrate	50	Yes	No	49 cents
11	Powder	100	No	No	35 cents
12	Concentrate	100	Yes	No	79 cents
13	Premixed	200	No	No	79 cents
14	Premixed	50	Yes	No	35 cents
15	Concentrate	100	Yes	Yes	35 cents
16	Premixed	50	No	Yes	35 cents
17	Concentrate	50	No	No	49 cents
18	Powder	50	Yes	Yes	79 cents
Holdout Validation Profiles					
19	Concentrate	100	Yes	No	49 cents
20	Powder	100	No	Yes	35 cents
21	Powder	200	Yes	Yes	79 cents
22	Concentrate	50	No	Yes	35 cents

The conjoint analysis experiment was administered during a personal interview. After collecting some preliminary data, the respondents were handed a set of 22 cards, each containing one profile description. A ratings measure of preference was gathered by presenting each respondent with a foldout form that had seven response categories, ranging from “not at all likely to buy” to “certain to buy.” Respondents were instructed to place each card in the response category best describing their purchase intentions. After initially placing the cards, they were asked to review their placements and rearrange any cards, if necessary. The validation profiles were rated at the same time as the other profiles but withheld from the analysis at the estimation stage. Upon completion, the interviewer recorded the category for each card and proceeded with the interview. A total of 86 respondents successfully completed the entire conjoint task.

Your Tasks:

(2.1) Derive the part-worth estimates by running multiple linear regression model. Interpret the results. Calculate attribute importance. Interpret the results.

(2.2) HBAT used the conjoint analysis results to evaluate three possible products. The products were formulated to identify whether a new value product line might be viable. As such, the new product plus two existing product configurations were developed to represent the existing products. In our example, products 1 and 2 are existing products, and product 3 is new:

• *Product 1*. A premixed cleanser in a handy-to-use size (50 applications per container) that was environmentally safe (biodegradable) and still met all sanitary standards (disinfectant) at only 79 cents per application.

• *Product 2*. An industrial version of product 1 with the same environmental and sanitary features, but in a concentrate form in mid-size containers (100 applications) at the low price of 49 cents per application.

• *Product 3*. A real cleanser value in powder form in economical sizes (200 applications per container) for the lowest feasible price of 35 cents per application that was neither biodegradable nor disinfectant.

Given the part-worth estimates, derive the utility values of these products. Among the three products, which one is most and least favored by the 86 industrial customers at an aggregate level?

Note: The HBAT conjoint study data is stored in “HBAT_CONJOINT_Long.csv”. The variable “QN” indicates the unique ID assigned to each industrial customer sampled. The variable “Card” records the product profile presented. You can use the data for all these 22 product profiles in your analysis.