

Task

The following points relate to the Final Assignment in Week 8:

- This is an individual task and no group work is allowed
- All questions in the Final Assignment are to be answered
- All calculations and interpretations are to be provided in Word (or PDF or Excel) format.

Task Briefing

The below table shows the sales per year given the expenditure on advertising and the number of employees for the respective year.

Year	Sales (millions Euros)	Advertising (thousands Euros)	Number of Employees
1	651	23	10
2	762	26	12
3	856	30	16
4	1063	34	20
5	1190	43	22
6	1298	48	22
7	1421	52	23
8	1440	57	25
9	1518	58	25
10	1590	58	25
11	1650	62	27
12	1800	70	37
13	1820	65	38
14	1900	68	38
15	1950	72	40
16	2050	72	40
17	2100	73	41
18	2180	74	42
19	2260	76	43
20	2320	78	44

1.) Do you think that the amount spent on advertising every year made an impact on the annual sales? (25 points)

Discuss your answer by making use of a Hypothesis Test and given that the sales prior to investing in advertising for the previous 20 years were as follows:

Sales Before Advertising	455.7	533.4	599.2	744.1	833	908.6	994.7	1008	1062.6	1113	1155	1260	1274	1330	1365	1435	1470	1526	1582	1624
---	-------	-------	-------	-------	-----	-------	-------	------	--------	------	------	------	------	------	------	------	------	------	------	------

(TIP: If there was an improvement in sales then the average of sales would have increased)

1.1 What do you think is the most appropriate Hypothesis Test?

1.2 What is the Null Hypothesis? What is the Alternative Hypothesis?

1.3 By making use of a t-test, assess whether or not advertising has led to a significant increase in sales. Present your results as well as interpret the results.

2.) Assume the variable annual sales follows a Normal Distribution. Estimate the population mean with a Confidence Interval of 95%. (20 points).

3.) Use the above table of data and choose a Simple Random Sample (SRS) of five. Start at the beginning of the list and attach labels to the years. What sample do you obtain? Show all your steps. (10 points)

4.) Determine the relationship between advertising and sales. (35 points)

a. Plot a Scatter plot of the data (sales vs advertising). Interpret the plot?

b. Calculate the linear regression equation that best fits the data and explains the independent and dependent variables. (TIP: dependent variable = Sales; independent variables = Advertising & Number of Employees).

c. Calculate the correlation coefficient and interpret the result.

d. Estimate the sales for the 21st year of business if advertising is 90 and the number of employees as 50.

e. Estimate the sales for the 22nd year of business if advertising is 100 and the number of employees as 55.

f. Interpret the Goodness of Fit measure for the regression model provided in (a.).

Formalities:

- Wordcount: 1000 - 1500
- Cover, Table of Contents, References and Appendix are excluded of the total wordcount.
- Font: Arial 12,5 pts.

- Text alignment: Justified.
- The in-text References and the Bibliography have to be in Harvard's citation style.

Submission: Week 8 – Via Moodle (Turnitin). 20 September 2020, 23:59.

Weight: This task is a 60% of your total grade for this subject.

It assesses the following learning outcomes:

- Understand the complex calculations, methodologies and techniques to derive a sound conclusion
- Understand statistical language and the development of statistical thinking
- Ability to understand and answer complex statistical problems
- Ability to interpret calculated results and provide insight to the questions asked

Rubrics

	Exceptional 90-100	Good 80-89	Fair 70-79	Marginal fail 60-69
Knowledge & Understanding (20%)	Student demonstrates excellent understanding of key concepts and uses vocabulary in an entirely appropriate manner.	Student demonstrates good understanding of the task and mentions some relevant concepts and demonstrates use of the relevant vocabulary.	Student understands the task and provides minimum theory and/or some use of vocabulary.	Student understands the task and attempts to answer the question but does not mention key concepts or uses minimum amount of relevant vocabulary.
Application (30%)	Student applies fully relevant knowledge from the topics delivered in class.	Student applies mostly relevant knowledge from the topics delivered in class.	Student applies some relevant knowledge from the topics delivered in class. Misunderstanding may be evident.	Student applies little relevant knowledge from the topics delivered in class. Misunderstands are evident.
Critical Thinking (30%)	Student critically assesses in excellent ways, drawing outstanding conclusions from relevant authors.	Student critically assesses in good ways, drawing conclusions from relevant authors and references.	Student provides some insights but stays on the surface of the topic. References may not be relevant.	Student makes little or none critical thinking insights, does not quote appropriate authors, and does not provide valid sources.
Communication (20%)	Student communicates their ideas extremely clearly and concisely, respecting word count, grammar and spellcheck	Student communicates their ideas clearly and concisely, respecting word count, grammar and spellcheck	Student communicates their ideas with some clarity and concision. It may be slightly over or under the wordcount limit. Some misspelling errors may be evident.	Student communicates their ideas in a somewhat unclear and unconcise way. Does not reach or does exceed wordcount excessively and misspelling errors are evident.