Dublin Business School

QQI

BA (HONS) Accounting and Finance

BA (HONS) Financial Services

SUMMER 2024 EXAMINATIONS

Module Code: **B6AF114**

Module Description: **Business Maths & Research Methods**

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External Examiner: **Shane Moran**

INSTRUCTIONS TO CANDIDATES

Time allowed is two hours.

Answer all questions in Section A (50 marks)

Answer any two questions in Section B (50 marks)

Total 100 marks

Students are allowed to use a scientific calculator.

SECTION A – ANSWER ALL QUESTIONS IN THIS PART

1. A bank account pays 5.9 % interest per year. Angela deposits EUR 98,000 today.

   a. How much will be in the account after 20 years if interest is compounded quarterly?
   (3 marks)

   b. How much will be in the account after 20 years if interest is compounded continuously?
   (3 marks)

   c. Calculate the AER in case a. above (to three decimal places).
   (3 marks)

   d. Explain the concept of AER in the context of saving.
   (1 mark)

   (Total: 10 marks)

2. The table below shows the cash flows generated by an investment (in EUR).

Timing	Cash flows (EUR)
Time 0 (start)	- 950,000
Year 1	90,000
Year 2	258,000
Year 3	365,000
Year 4	430,000

   a. The company applies a discount rate of 8.5% for this investment. Calculate the net present value (NPV). Should the investment be accepted?
   (5 marks)

   b. Calculate the investment's internal rate of return (IRR).

   (5 marks)

   (Total: 10 marks)

3. A business faces a daily demand function (in number of units of a good) $D(P) = 650 - 5P$ where P is the selling price in Euro.

   a. Find and write down the daily revenue function. Call the function $R(P)$.
   (3 marks)

   b. Find the price that maximizes daily revenue.
   (4 marks)

   c. What is the number of units per day that maximizes daily revenue?

   (3 marks)

   (Total: 10 marks)

4. Answer both parts.

   a. Outline the ten steps in research process.
   (7 marks)

   b. Explain what a stratified sample is.

   (3 marks)

   (Total: 10 marks)

5. This set of data contains the number of items bought by a sample of 15 randomly selected shoppers in a local supermarket. Results are sorted in increasing order.

4	9	12	15	20	22	22	24	25
29	29	32	33	38	43	44	50	66

   a. Calculate the mean and standard deviation.
   (4 marks)

   b. Draw a Box Plot (also called a Box and Whisker Diagram) of the data.

   (6 marks)

   (Total: 10 marks)

SECTION B – ANSWER ANY TWO OF QUESTIONS 6, 7, 8

QUESTION 6 - REGRESSION AND CORRELATION

A hotel has advertised on the national radio station for the past 8 weeks their weekend overnight stays. The number of bookings they received each week and the number of advertisements they placed each week are shown in the table below.

Number of advertisements	Number of bookings
3	18
9	36
7	46
11	52
6	32
15	81
9	61
13	70

They use an OLS regression model to estimate the relationship between the number of advertisements placed and the number of bookings received.

a. Identify the independent variable (X) and the dependent variable (Y).
(1 mark)

b. Create a clearly annotated scatter diagram of the data. Do you see a positive or a negative relationship in the chart? Is it a strong relationship?
(4 marks)

c. Explain the concept of correlation in detail.
(3 marks)

d. Calculate the Pearson's Coefficient of Correlation for the data above. Interpret the result.
(4 marks)

e. Find the linear regression (OLS) equation for the data in question.
(3 marks)

f. Draw the regression line you found into the scatter diagram you drew in part b.
(2 marks)

g. Calculate the coefficient of determination for the data. Explain your result.
(3 marks)

h. Use the regression equation you calculated in part e. to forecast the value of expected number of bookings if the company places 25 advertisements.
(3 marks)

i. Is the prediction in part h. above a valid prediction? Explain why.

(2 marks)

(Total 25 marks)

QUESTION 7: INDEX NUMBERS

I. A financial manager maintains a portfolio of shares and a property portfolio. The table shows the values of the two portfolios (in millions of euro) at the end of each year.

Year	2017	2018	2019	2020	2021	2022	2023
Growth Fund	34.14	36.78	34.75	39.11	44.48	49.92	51.85
Stability Fund	322.15	329.64	339.44	380.49	390.41	404.55	418.66

a. Calculate a simple index for the Growth Fund. Use 2017 as the base year and use 100 as the base value.
(3 marks)

b. Calculate a simple index for the Stability Fund. Use 2017 as the base year and use 100 as the base value.
(3 marks)

c. Create a line chart showing the two index series. Label the chart appropriately.
(3 marks)

d. List two advantages to using a simple index instead of the underlying data (in millions of euro).
(3 marks)

e. Using the simple index, calculate the percentage change from 2017 to 2023 for each portfolio.

(3 marks)

II. The table shows changes in prices and quantities of three goods that form a consumption basket.

	2020		2021		2022	
Product	Price	Quantity	Price	Quantity	Price	Quantity
A	€21	7	€26	9	€32	9
B	€13	8	€14	10	€20	9
C	€66	6	€69	8	€73	12

a. Calculate the Laspeyres index for each of the three years. Use 2020 as the base year and use 100 as the base value. Leave your answers rounded to 1 decimal place.
(4 marks)

b. Calculate the Paasche index for each of the three years. Use 2020 as the base year and use 100 as the base value. Leave your answers rounded to 1 decimal place.
(4 marks)

c. Calculate the inflation in 2022 using the Paasche method.
(2 marks)

(Total 25 marks)

QUESTION 8: PROBABILITY AND INFERENTIAL STATISTICS

I. A box contains 4 red, 14 white and 12 blue balls. Round all answers to four decimal places.

a. One ball is chosen from the box. What is the probability that the ball is red?
(2 marks)

b. Two balls are chosen, without replacing the first. Calculate the probability that both balls are white.
(2 marks)

c. Two balls are chosen, without replacing the first. Calculate the probability that the balls are the same colour.
(3 marks)

II. A company tests their employees maths skills. On average, 85 percent of tested employees pass the test. One day four employees are tested.

a. Calculate the probability that all four pass the test.
(2 marks)

b. Write the probability distribution of the random variable as a table. The random variable is the number of employees who passed the test.
(4 marks)

III. A machine packs sweets in bags. The weights of the bags are normally distributed with a mean of 500 grams and a standard deviation of 20 grams. If one bag is randomly chosen, calculate the probability that:

a. The bag weighs more than 500 grams.
(2 marks)

b. The bag weighs less than 525 grams.
(2 marks)

c. The bag weighs between 480 and 515 grams.
(3 marks)

IV. An airline assumes that the average male passenger weighs 80 kilograms. They weighed a random sample of 100 male passengers and the sample mean was 82.2 kilograms and the sample standard deviation was 15.3 kilograms.

a. Calculate a 95% confidence interval for the true mean weight of male passengers.
(3 marks)

b. What conclusion should the airline come to about the accuracy of the assumption that the average male passenger weighs 80 kilograms?
(2 marks)

(Total 25 marks)

FORMULA SHEET - You are advised to use the statistics (STAT) mode on your calculator to calculate the standard deviation, correlation, OLS regression equation, and R^2.

1. Statistics

(i) Standard deviation (sample) $s = \sqrt{\frac{\Sigma \quad (x-\bar{x})^2}{n-1}}$

(ii) Geometric Mean $\sqrt[n]{(1+r_1)(1+r_2)(1+r_3)(1+r_n)} \quad - 1$

2. Index Numbers

(i) Simple index $\frac{Current\ Value}{Base\ Value} \times 100$

(ii) Laspeyres index $\frac{\Sigma \quad Q_0 P_n}{\Sigma \quad Q_0 P_0} \times 100$

(iii) Paasche index $\frac{\Sigma \quad Q_n P_n}{\Sigma \quad Q_n P_0} \times 100$

3. Financial Maths

(i) Discrete compounding $V = A \times \left(1 + \frac{r}{m}\right)^{(m \times T)}$

(ii) Continuous compounding $V = A \times e^{(r \times T)}$

(iii) Present value of a future cash flow $PV = \frac{C}{(1+r)^T}$

(iv) IRR $IRR = \frac{NPV_1 r_2 - NPV_2 r_1}{NPV_1 - NPV_2}$

(v) PV of an annuity $PV = \frac{C}{r} \times \left(1 - \frac{1}{(1+r)^T}\right)$

4. Regression Analysis

(i) Pearson's correlation coefficient $r =$

$$\frac{n\sum(xy)-\sum x\sum y}{\sqrt{\left[n\sum x^2-\left(\sum x\right)^2\right]\left[n\sum y^2-\left(\sum y\right)^2\right]}}$$

(ii) OLS regression equation $y = a + bx$

$$b = \frac{n\sum xy-\sum x\sum y}{n\sum x^2-(\sum x)^2} \qquad a = \frac{\sum y-b\sum x}{n}$$

(iii) Coefficient of determination $R^2 = 1 - \frac{\sum(y-\hat{y})}{\sum(y-\bar{y})}$

5. Probability

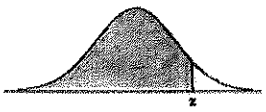
(i) Binomial probability distribution $P(r\ successes) = (n\,r) \times p^r \times q^{n-r}$

(ii) Normal distribution z-scores $z = \frac{x-\mu}{\sigma}$

6. Inferential Statistics

(i) 95% Confidence Interval for the mean $\bar{x} \pm 1.96 \times \frac{\sigma}{\sqrt{n}}$

(ii) 95% Confidence Interval for the proportion $\hat{p} \pm 1.96\sqrt{\frac{\hat{p}\hat{q}}{n}}$



Probability Content from $-\infty$ to Z

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990