

**Business and Marketing**

**Business Mathematics**

**Summative Coursework**

**Assignment (Statistics and Probability)**

**2020 – 21**

Overview

You will undertake several statistical investigations using appropriate software and present your findings in a word processed document.



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| **Assessment Details:** | | | | | |
| **Hand out**  **Date:** | 01/07/2021 | **Submission**  **Date:** | 14/07/2021 | **Assessment**  **Duration:** | 2 Weeks |
| **Instructions:** | | | | | |
| Prepare a report using an appropriate word processing package e.g. Microsoft Word, to explain your investigations into the tasks specified in this assessment. Please include appropriate images and results of the work done (calculations and Excel/Geogebra) to support your reported findings. Your completed work should be uploaded to study smart in a single word-processed report.   * The maximum mark for this assessment is 37 and will comprise **25%** of your overall mark for the module. * **Learning outcomes assessed**: Knowledge and Understanding   KU2: Evaluate the strengths and weaknesses of alternative models, and consequently, of any conclusions drawn.  Subject Specific Skills  SS3: Identify, simplify and abstract the underlying mathematical structure of a business situation allowing a business-related problem to be modelled.  SS4: Solve a range of business-related problems either deterministically or probabilistically as appropriate.  SS5: Choose and apply appropriate techniques in algebra and calculus in finding a solution to a problem.  Key and Employability Skills  KE6: Use a range of IT packages, including calculators, spreadsheets, word processors and skills in the analysis and solution of business problems. | | | | | |



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| **Evidence for Assessment:** |
| Report written using an appropriate word processing package. |
| **Submission Details:** |
| ***The deadline for the submission of your report is 14/07/2021.***  ***On completion, your report should be uploaded, using only your Student ID, to the Assessment Tab on Study Smart. You must not use your name on the submission, either within the document or as the file name when uploading to TurnItIn.***  ***All submissions will be processed utilising TurnitIn and compared with documents on the Internet.***  ***Your report needs to be original. If it is believed from the TurnitIn report or otherwise, that your assignment is too similar to another work, you will be asked to explain your report during a live viva.*** |
| **Academic Impropriety:** |
| ***You are reminded that plagiarism is the unreferenced use of other people’s work or your own previous work. This could include visual images, sound recordings, diagrams, as well as written text. You can however use other people’s work as examples, supporting evidence or inspiration as long as it is referenced appropriately.***  ***Academic Impropriety also includes copying or using other people’s work and presenting this as your own. This could include work produced by family members, friends or unknown people on the Internet.***  ***If you are guilty of Academic Impropriety you are likely to have your grade for the assignment reduced to zero.*** |

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| **Investigation 1** | | | | | |
| The airline company AlpineAir collected passenger data to investigate the demand in premium economy class versus economy class seats. The table below shows the length of flights and  number of seats sold over a certain period. | | | | | |
|  | Flight Length (mins) | passengers | Economy passengers |  | |
| -60 | 359 | 382 |
| -90 | 385 | 379 |
| -120 | 326 | 360 |
| -150 | 314 | 323 |
| -180 | 371 | 327 |
| -210 | 365 | 341 |
| -240 | 312 | 315 |
| -270 | 350 | 376 |
| -300 | 360 | 385 |
| -330 | 324 | 392 |
| -360 | 310 | 388 |
| -390 | 301 | 371 |
| -420 | 338 | 392 |
| -450 | 373 | 399 |
| AlpineAir wishes to introduce new in-flight services to attract more customers. **Your task is to provide the AlpineAir board members with the characteristics of premium economy and economy seat sales considering the flight durations. Write a report using statistical methods and interpret your findings.** | | | | | |
| **Task 1 (Maximum 10 Marks)** | | | | | **Learning Outcome** |
| Using descriptive statistical methods, calculate: Mean, Modal Class, Standard Deviation, and Variance for both regions. Create box plot diagrams. Compare and contrast both economy and premium economy class sales’ figures based on your findings, and the box plot diagram. Include your tables/ formulae and boxplot diagrams in your report. | | | | | KU2 SS5 KE6 |

No of Economy

No of Premium

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| **Task 2 (Maximum 5 Marks)** | | | | | | | | | | | | **Learning Outcome** | | | |
| The AlpineAir board wishes to make changes in inflight services for flights within Europe which last between 80 minutes and 200 minutes inclusive.   1. Estimate the number of passengers flying economy and premium economy in this span of times. 2. What can you suggest to the board about inflight services considering   the number of different class of seats | | | | | | | | | | | | SS3 SS4 SS5 KE6 | | | |
| **Investigation 2** | | | | | | | | | | | | | | | |
| AlpineAir introduced the premium economy class last year and below is the data collected in 2020. | | | | | | | | | | | | | | | |
|  | 2020 | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | | Nov | Dec |  |
| **(in 100s)** | 9 | 4 | 10 | 11 | 5 | 7 | 5 | 8 | 11 | 9 | | 12 | 9 |
| **Business Class (in 100s)** | 12 | 11 | 5 | 6 | 9 | 11 | 11 | 7 | 4 | 4 | | 2 | 6 |
| You are asked to advise the AlpineAir board about the effect of the Premium Economy Class sales on the Business Class seat sales. | | | | | | | | | | | | | | | |
| **Task 3 (Maximum 3 Marks)** | | | | | | | | | | | | **Learning Outcome** | | | |
| Investigate the relationship between the Premium Economy Class and  Business Class seat sales. Explain if there could be other factors affecting the demand in Business Class sales. Provide an interpretation of your findings. | | | | | | | | | | | | KU2 SS5 KE6 | | | |
| **Task 4 (Maximum 3 Marks)** | | | | | | | | | | | | **Learning Outcome** | | | |
| AlpineAir is planning to release 1250 and 1400 premium economy seats in next two months. Your task is to estimate the number of Business Class seats that should be made available and give the right advise to the board. | | | | | | | | | | | | SS3 SS5 KE6 | | | |

**Premium Economy Class**

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| **Investigation 3** | | | | | | | | | | | | | | | | | | |
| AlpineAir’s data over the four years shows the demand in flights at different times of the day. M: morning, A: Afternoon, E: Evening, N: Night flights. The board of AlpineAir wishes to revise the pricing of the tickets. You are asked to advise the AlpineAir board by investigating the  data provided below. | | | | | | | | | | | | | | | | | | |
|  | Year | 2017 | | | | 2018 | | | | 2019 | | | | 2020 | | | | |
|  | Slots | M | A | E | N | M | A | E | N | M | A | E | N | M | A | | E | N |
|  | Seats | 200 | 386 | 402 | 76 | 284 | 317 | 480 | 76 | 218 | 241 | 395 | 43 | 141 | 290 | | 333 | 16 |
|  | | | | | | | | | | | | | | | | | | |
| **Task 5 (Maximum 4 Marks)** | | | | | | | | | | | | | | | | **Learning Outcome** | | |
| Using suitable methods based on the data provided, provide a visual aid to show the fluctuation in number of seats throughout the years and the seasons. | | | | | | | | | | | | | | | | SS3 KE6 | | |
| **Task 6 (Maximum 3 Marks)** | | | | | | | | | | | | | | | | **Learning Outcome** | | |
| Explain and elaborate the trend throughout the four years for different times of a day and give an interpretation about the fluctuation for each slot. Explain the trendline equation and the differences between the trend line values and the  observed values. | | | | | | | | | | | | | | | | KU2 SS3 SS5 | | |
| **Task 7 (Maximum 3 Marks)** | | | | | | | | | | | | | | | | **Learning Outcome** | | |
| Based on your findings, provide the AlpineAir board with the expected figures in 2021 for each slot. | | | | | | | | | | | | | | | | SS5 KE6 | | |

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| **Investigation 4** | |
| AlpineAir designed their airplane seating plan based on the previous years’ trend. 65% of the customers fly economy, 20% prefers business and the rest of the costumers are first class  flyers. For the next season all together 10000 tickets are ready to be released. | |
| **Task 8 (Maximum 3 Marks)** | **Learning Outcome** |
| You are asked to estimate the number of passenger for different classes and prepare a report about the expected figures to the board. Explain how you would predict the passenger numbers and justify your choice of probability  distribution model with reason(s). | SS3 SS4 |
| **Task 9 (Maximum 3 Marks)** | **Learning Outcome** |
| Calculate the probabilities that   1. there are fewer than 6400 economy passengers 2. there are a minimum of 2000 business class passengers 3. there are maximum 1700 and minimum 1500 first class passengers, Using excel, or otherwise, calculate the probabilities and include your   working / formulae in your report. | SS4 SS5 KE6 |

**Grade Rubric – Business Mathematics**

**Summative Coursework (Statistics and Probability)**

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| **TASK:** | **LEARNING OUTCOME** | **ASSESSMENT CRITERIA** | **0, 1** | **2, 3, 4** | **5, 6, 7** | **8, 9, 10** | **TOTAL MARK** |
| **Poor** | **Satisfactory** | **Good** | **Excellent** |
| Task 1 | KU2 | Descriptive | No evidence of | -Midpoints | -Mean, Modal | -Comparison of | **10** |
| SS5 KE6 | Statistics, comparing two  sets of data. | working or simply  frequency | -fx, fx^2  -Sigma values calculated. | Class, Variance and SD  calculated | SD/ Variances.  -IQRs. Q2s.  Skewness. |
|  |  | tables created |  | -Q1,2 and 3 and | -Detailed |
|  |  |  |  | IQR calculated. | discussion of |
|  |  |  |  | -Box plots | data |
|  |  |  |  | created | comparison. |

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| **TASK:** | **LEARNING OUTCOME** | **ASSESSMENT CRITERIA** | **0** | **1** | **2,3** | **4,5** | **TOTAL MARK** |
| **Poor** | **Satisfactory** | **Good** | **Excellent** |
| Task 2 | SS3 | Creating | No evidence | Class widths | Histogram | -Calculations | **5** |
| SS4 | Histograms | and frequency | chart inserted. | correct |
| SS5 |  | densities | X-axis labels | -Sensible |
| KE6 |  | calculated | are correct. | commentary / |
|  |  |  | -No gaps | suggestion |
|  |  |  | between the | about the |
|  |  |  | bars with | inflight |
|  |  |  | correct labels | services for |
|  |  |  | present | each classes. |

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| **TASK:** | **LEARNING OUTCOME** | **ASSESSMENT CRITERIA** | **0** | **1** | **2** | **3** | **TOTAL MARK** |
| **Poor** | **Satisfactory** | **Good** | **Excellent** |
| Task 3 | KU2 | Creating a | No evidence | Scatter graphs | Correlation | Interpretation of the calculation, strength, negative, positive and interpretation. Any other factors explained. | **3** |
| SS5 | scatter graph | inserted with | coefficient |
| KE6 | and working | correct data | calculated |
|  | out the |  |  |
|  | correlation |  |  |
|  | type |  |  |

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| **TASK:** | **LEARNING OUTCOME** | **ASSESSMENT CRITERIA** | **0** | **1** | **2** | **3** | **TOTAL MARK** |
| **Poor** | **Satisfactory** | **Good** | **Excellent** |
| Task 4 | SS3 | Regression | No evidence | Trend line | x value | Explanation of | **3** |
| SS5 | line equation | inserted | substituted in | reliability. |
| KE6 | and analysis of |  | the regression |  |
|  | predictions. |  | line equation; y |  |
|  |  |  | calculated |  |

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| **TASK:** | **LEARNING OUTCOME** | **ASSESSMENT CRITERIA** | **0** | **1** | **2** | **3, 4** | **TOTAL MARK** |
| **Poor** | **Satisfactory** | **Good** | **Excellent** |
| Task 5 | SS3 | Time Series | No Evidence | 4 point moving | Centred | -Graph | **4** |
| KE6 | Analysis, | averages | moving | inserted |
|  | calculating | calculated | averages | -trend line |
|  | moving and |  | created | shown |
|  | centred |  |  |  |
|  | averages, |  |  |  |
|  | creating the |  |  |  |
|  | chart with the |  |  |  |
|  | trend line |  |  |  |

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| **TASK:** | **LEARNING OUTCOME** | **ASSESSMENT CRITERIA** | **0** | **1** | **2** | **3** | **TOTAL MARK** |
| **Poor** | **Satisfactory** | **Good** | **Excellent** |
| Task 6 | LO2 LO3 LO5 | Understanding the time series, interpretation of it and  comparing the trend line values | No Evidence | The pattern recognised | Comparison of trend line values vs observed values | Seasonal effect explained | **3** |
| vs observed |
| values. |
| Seasonal |
| effects |

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| **TASK:** | **LEARNING OUTCOME** | **ASSESSMENT CRITERIA** | **0** | **1** | **2** | **3** | **TOTAL MARK** |
| **Poor** | **Satisfactory** | **Good** | **Excellent** |
| Task 7 | LO5 | Using the | No Evidence | Trend line | Seasonal | Seasonal | **3** |
| LO6 | trend line in | equation used | effect | effects applied |
|  | time series | and at least a | calculated for | to trend line |
|  | and | one slot in | each season | values and |
|  | application of | 2021 |  | adjusted |
|  | seasonal | calculated |  | predictions are |
|  | adjustment |  |  | present |

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| **TASK:** | **LEARNING OUTCOME** | **ASSESSMENT CRITERIA** | **0** | **1** | **2** | **3** | **TOTAL MARK** |
| **Poor** | **Satisfactory** | **Good** | **Excellent** |
| Task 8 | LO3 | Recognising | No Evidence | Correct model | Explanation of | Interpretation | **3** |
| LO4 | binomial | stated and | why the | of the model |
|  | distribution | notation is | ‘correct model’ | and the reason |
|  | model and | typed | was used | why this task |
|  | notation of it |  |  | requires the |
|  |  |  |  | distribution |
|  |  |  |  | used. |

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| **TASK:** | **LEARNING OUTCOME** | **ASSESSMENT CRITERIA** | **0** | **1** | **2** | **3** | **TOTAL MARK** |
| **Poor** | **Satisfactory** | **Good** | **Excellent** |
| Task 9 | LO4 LO5 LO6 | Understanding the binomial distribution function | No Evidence | Correct function is used | At least one correct calculation | All the calculations are correct. | **3** |