**Course Work Answer Book**

**UNIVERSITY COURSE WORK**

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| REGISTRATION NUMBER | | | | | | | | | VU-BSF-2209-0796-DAY | | | | | | |
| Title of The Program (eg BBA, BSC, BPH, BSWA) | | | | | | | | | | | | | BSF | | |
| Bachelor of Science in Software Engineering | | | | | | | | | | | | | | | |
| Department | | | | Other Depts in Faculty of Science and Technology | | | | | | | | | | | |
| Faculty | Faculty of Science and Technology | | | | | | | | | | | | | | |
| Year Of study (YrI , YrII, YrIII, or YrIV) | | | | | | | | | | | 2 | | | | |
| Module Code and Name | | | | | | | 3204 ST | | | | | | | | |
| Modelling and Simulation | | | | | | | | | | | | | | | |
| Semester | | | 3 | | | | | | | | | | | | |
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| Retake: | | Yes | | |  | | | No | |  | | (Tick whichever is applicable) | | | |
| Date of Course Work | | | | | | Sun Sep 01 2024 16:08:33 GMT+0300 (East Africa Time) | | | | | | | | | |
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| **DIRECTIONS TO CANDIDATES (Turn to page ii for more instructions).** | | | | | | | | | | | | | **FOR USE BY EXAMINERS ONLY** | | |
| **Question Number** | **Internal Examiner** | **External Examiner** |
| 1. Leave margin blank. 2. Begin each answer on a fresh page. 3. Write the number of each question and theCandidate's Number at the top of each page. 4. Write the numbers of the questionswhich you have attempted, with subsections where necessary, in the spacesprovided below | | | | | | | | | | | | |
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| **NUMBER OF QUESTIONS** you have answered in the order in which you have written them | | | | | | | | |
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**How and where should I submit my Course Work script?**

Every student will be required to submit their Course Work via [VClass Students Portal](https://vclass.ac/) E.g. you go to [www.vclass.ac](http://www.vclass.ac) and login, to your account, then on the left sidebar menu **click on Course Work**.

Under Course Work you will see the following: -

1. Instructions for that particular Course Work with time required to finish your Course Work as per instructions,
2. A student will be required to download the question paper and the answer sheet provided by the university within the same module Course Work, or a student can be required to attempt structured questions within the system depending on how the Course Work was set.
3. Submission of answered questions is done,
4. Student is required to click to **consent** to show that the answered Course Work belongs to them.
5. **Note** that if Course Work is for download, a student will be required to download the question paper and answer sheet, do their Course Work within the given stipulated time.
6. Required to scan and upload back the answered booklet through the same portal as per format available.
7. Course Work uploaded will directly be received by the Registry department.
8. Students here are required to use [VClass e-Learning system](https://vclass.ac)for all Course Work and for any failure they can contact the Registry department for guidance.
9. No late submission will be accepted.

**Avoid any malpractice because this will attract severe penalties such as invalidating the answered script whose consequences will attract retakes.**

First Question: E-commerce Store Checkout Process Simulation  
Our goal in running this simulation is to identify two crucial performance indicators for a checkout procedure with one cashier and a queue of customers:  
  
The average amount of time a client spends in the system (W) comprises both the waiting and servicing periods.  
The percentage of idle time (1-ρ) indicates how frequently the cashier is not serving customers.  
Primary Premises and Configuration:  
Interarrival Times: equitably spaced out from one to fifteen minutes.  
Service Durations: equitably spaced out from one to eight minutes.  
The three-hour (180-minute) scenario is repeated for a total of twenty consumers.

2. Excel Simulation Steps: Produce Random Times:  
  
Interarrival Times: To create random interarrival times between one and fifteen minutes, use the formula =ROUND(RAND()\*(15-1)+1,0).  
Service Times: To get service times ranging from one to eight minutes, use the formula =ROUND(RAND()\*(8-1)+1,0).  
Determine Arrival Times:  
  
The first consumer arrives at zero.  
For future consumers, arrival timings are computed as follows:

Arrival Time (Customer n) = Arrival Time (Customer n-1) + Interarrival Time (Customer n)

**Service Start and End Times**:

* The service start time for the first customer is equal to the **arrival time**.
* For subsequent customers, the service starts when the cashier is free, which is either at the customer’s arrival time or after the previous service ends:

Service Start Time (Customer n) = MAX(Arrival Time (Customer n), Service End Time (Customer n-1))

The service end time is:

Service End Time = Service Start Time + Service Time

**Waiting and System Time**:

* **Waiting Time** = Service Start Time - Arrival Time.
* **System Time** = Service End Time - Arrival Time.

**Idle Time**:

* **Idle Time** between customers is calculated as

Idle Time (Customer n) = MAX(0, Service Start Time (Customer n) - Service End Time (Customer n-1))

**Performance Metrics**:

**Average time in system (W)**: This is the average of the **System Time** for all customers.

Average W = AVERAGE(System Times)

**Proportion of Idle Time**: The total idle time divided by the total simulation time (180 minutes).

Idle Time Proportion = (Total Idle Time) / 180

**Lastly Data Table for Replications:**

* Highlight the range for 50 replications, covering columns for Average W and Idle Time Proportion.
* Use **What-If Analysis** > **Data Table** to simulate 50 replications. Choose a blank cell for the column input.

Question Two: Modeling Life Expectancy Using Socio-Economic Factors

The task in Question Two is to model and understand how socio-economic factors like GDP, adult mortality, and immunization rates affect life expectancy in different countries using the "Life Expectancy (WHO)" dataset from Kaggle.

1. Importing and Cleaning Data in SPSS

- Download the dataset from Kaggle and open it in SPSS.

- Clean the data by:

- Checking for missing values and either removing them or filling them using averages (mean/median).

- Removing any extreme values (outliers) that may affect your analysis.

2. Running a Multiple Linear Regression

The goal is to understand how factors such as GDP, adult mortality, and immunization rates influence life expectancy.

- Life Expectancy is the Dependent Variable (DV) — this is what you're trying to predict.

- The Independent Variables (IVs) are:

- GDP (a measure of a country's economic strength).

- Adult Mortality (how many adults die in a certain period).

- Immunization Rates (like vaccination coverage for diseases).

Steps to Run Regression in SPSS:

- Go to Analyze > Regression > Linear.

- Set Life Expectancy as the dependent variable and GDP, Adult Mortality, and Immunization Rates as independent variables.

- Run the regression to see how much each factor influences life expectancy.

3. Simulating Changes in Socio-Economic Factors

- After building the model, you can simulate what happens if certain factors change:

- For example, increase GDP by 10% and see how life expectancy improves.

- Reduce adult mortality and observe its impact on life expectancy.

4. Model Validation

- Check how well your model predicts life expectancy by comparing the predicted values with the actual values in the dataset.

- Look for any major errors or patterns in the differences between predicted and actual values.

5. Sensitivity Analysis

- Change one factor at a time (like GDP or mortality) to see how much life expectancy changes. This helps you understand which factors have the biggest impact.

Summary of Results

- Summarize what the analysis shows: how GDP, mortality, and immunization rates influence life expectancy.

- Discuss what this means for public health policies. For example, improving GDP and immunization rates can lead to longer, healthier lives in many countries.

Key Formulas:

- Life Expectancy Regression Model:

Life Expectancy = β0 + β1\*GDP + β2\*Adult Mortality + β3\*Immunization Rates + ε

Where each β shows how much the socio-economic factors influence life expectancy.

This simplified process allows you to model and simulate how life expectancy is influenced by key socio-economic factors, providing insights for improving public health outcomes.