**Course Work Answer Book**

**UNIVERSITY COURSE WORK**

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| REGISTRATION NUMBER | | | | | | | | | VU-BIT-2201-0543-DAY | | | | | | |
| Title of The Program (eg BBA, BSC, BPH, BSWA) | | | | | | | | | | | | | BIT | | |
| Bachelor of Information Technology | | | | | | | | | | | | | | | |
| Department | | | | Other Depts in Faculty of Science and Technology | | | | | | | | | | | |
| Faculty | Faculty of Science and Technology | | | | | | | | | | | | | | |
| Year Of study (YrI , YrII, YrIII, or YrIV) | | | | | | | | | | | 3 | | | | |
| Module Code and Name | | | | | | | 3109 FST | | | | | | | | |
| Simulation and Modelling | | | | | | | | | | | | | | | |
| Semester | | | 2 | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| 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 | | | | | | | | |
| 01 | 02 |  |  |  |  |  |  |  |

**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.**

**Question one**

<https://youtu.be/IDwTHKTRxfk>

**Question 1 (iv); Write a brief report summarizing your results and the methodology used to conduct the simulation**

**Introduction:**

This simulation was conducted to model the checkout process at a small gift shop with one cashier and 20 customers. The objective was to measure two key performance metrics:

The average time a customer spends in the system for both waiting and being serviced.

The percentage of time the cashier is idle during a 3-hour (180-minute) period.

**Assumptions:**

Interarrival Time: The time between customer arrivals which follows a uniform distribution between 1 and 15 minutes.

Service Time: The time required to serve each customer is uniformly distributed between 1 and 8 minutes.

Number of Customers (Customer ID): 20 customers are simulated for each replication.

Simulation Period: 3 hours (180 minutes).

**Methodology:**

Data Generation:

* I used Microsoft Excel’s =RANDBETWEEN () function to randomly generate customer interarrival times (between 1 and 15 minutes) and service times (between 1 and 8 minutes) for 20 customers.
* The arrival time for each customer was calculated by cumulatively adding the interarrival times (previous customer + current customer)
* The service start time for each customer was calculated as the later of the customer’s arrival time or the previous customer’s service end time.
* The service end time was computed by adding the service time to the service start time.
* The time in the system for each customer was determined as the difference between their service end time and arrival time, including both waiting and service times.
* The idle time of the cashier was calculated as the gap between the service start time of the current customer and the service end time of the previous customer. If no gap existed, idle time was recorded as zero.

**Performance Metrics:**

Average Time in System (W): The average of the "Time in System" for all 20 customers was calculated using =AVERAGE (all Time\_In\_System for 20 customers) in Excel.

Percentage of Idle Time: The total idle time was calculated by summing all idle times and dividing it by the total simulation time (180 minutes). =SUM (idle time for all 20 customers)

**Multiple Replications**:

To account for variability, the simulation was replicated 50 times using Excel’s Data Table feature, allowing the calculation of average performance metrics across multiple runs.

**Results**:

The results of the simulation provided the following performance metrics:

Average Time in System (W): Across 50 replications, the average time a customer spent in the system, including both waiting and being serviced, was approximately 5 to 20 minutes depending on customer arrival patterns and service times.

Percentage of Idle Time: The cashier’s idle time ranged from 15% to 30% of the total simulation time, depending on how interarrival times were distributed across customers.

**NOTE:** The checkout process simulation revealed that the time customers spend in the system and the cashier’s idle time can vary significantly depending on customer arrival patterns and service duration. The average time in the system was reasonable for a small gift shop, while the idle time reflected periods when no customers were waiting in line, thus allowing the cashier to be available for new arrivals.

By replicating the simulation 50 times, we obtained more reliable and stable estimates of the average customer time in the system and the percentage of idle time, which would assist in optimizing the checkout process and improving the efficiency of the store.