



# **NEUMANN'S MATRIX**

## **STUDY GUIDE**



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## INTRODUCTION

"Neumann's Matrix" is the computer science module at Beaconhouse Notion of Academia '25, designed to ignite a passion for technology and innovation among delegates. Teams will tackle coding challenges, experiment with image manipulation, explore data visualization, and apply machine learning to solve real-world problems. This dynamic module fosters creativity, collaboration, and competition, allowing delegates to unlock the potential of computer science while working with like-minded peers.

- There will be elimination following the first and second rounds
- Delegates are required to bring their own devices for all the three rounds

## ROUND 1: NEURAL INSIGHTS

In the thrilling first round, "Neural Insights," delegates will be challenged to apply artificial intelligence and data science skills to solve dynamic, real-world problems. Delegates will demonstrate expertise in model training, data analysis, and visualization using Python libraries like Matplotlib, Seaborn, or Plotly.

In the first phase, delegates will be tasked with creating a simple object recognition system using YOLO models. Initially working with corrupted training images, their first task will be to restore the dataset through image manipulation and data processing techniques, the exact methodology for which is given in the study resources. Once the dataset is rectified, delegates will engage in data annotation, meticulously labeling images to ensure effective model training. Using the prepared dataset, they will create an object detection system, guided by detailed instructions provided in the study pack. Trained models will be rigorously tested for accuracy, precision, and effectiveness. All bash commands necessary for the model training and for environment configuration will be provided as command prompt files (.cmd files) which delegates must execute on their systems. This file will be made available to delegates when the round officially begins.

In the second phase, delegates will assume the role of data analysts, scrutinizing a provided dataset to uncover trends, patterns, and anomalies.



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Using tools like Matplotlib, Seaborn, or Plotly, they will create visually compelling graphs that transform raw data into actionable insights. Delegates will then answer a comprehensive questionnaire, analyzing their graphs to extract meaningful conclusions. The questionnaire, delivered via a Google form, must be completed within the round's timeframe. This phase tests delegates' ability to think critically, interpret data, and craft visual narratives, assessing their analytical proficiency in deriving insights from complex datasets.

"Neural Insights" invites delegates on an exhilarating journey of exploration and innovation in AI and Data Science. With hands-on challenges and real-world applications, they will hone their skills, unleash creativity, and revel in the thrill of discovery.

## ROUND 2: CODECEPTION

In the exhilarating second round, "Codeception," delegates will be tested on proficiency in algorithms, programming logic, and problem-solving under pressure. This round offers a rigorous test of programming skills, fostering sharpness and agility in navigating algorithmic challenges.

Hosted on the DOMJ platform, delegates will tackle 15 meticulously designed problems, requiring precision, efficiency, and creativity. The round emphasizes mastery of programming concepts, pushing delegates to craft concise and efficient solutions within strict time constraints. Success hinges on speed, accuracy, and the ability to solve complex computational puzzles with clarity and focus.

The following concepts will be tested: Programming Concepts, Logical Problem-solving, Data Structures (Stacks/Queues), Recursion, String and Bit Manipulation, Mathematical Computation, Greedy Algorithms, and Pattern Printing.

"Codeception" promises delegates an electrifying challenge, blending speed, precision, and creativity to conquer intricate algorithmic puzzles. With high-stakes problem-solving and a focus on mastery, this round ensures an exhilarating test of skill, fostering agility and a passion for programming excellence.



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## ROUND 3: ERROR 403

In the climactic third round, "Error 403," delegates will be immersed in an electrifying cybersecurity challenge, testing their expertise in hacking strategies and cryptographic techniques. Tasked with infiltrating a secure system during a high-stakes espionage scenario, delegates will uncover critical data by navigating intricate cybersecurity puzzles.

Delegates must demonstrate expertise in encryption methods, system penetration techniques, and logical reasoning to outwit advanced security defenses. The mission concludes with the successful extraction and submission of classified information within the given timeframe.

The following concepts will be tested: Ethical Hacking Techniques, Cryptography, Simple Ciphers, Symmetric and Asymmetric Encryption, Network Traffic, and Packet Sniffing.

Delegates are required to use local code editors, such as Visual Studio, with all necessary files pre-configured and provided within the Virtual Machines. They must copy these files to their local systems for tasks like executing Python scripts, as modifications can only be made locally. Files on the Virtual Machine cannot be altered. The round involves programming decryption tasks, so delegates must be proficient with Python libraries like pyopenssl and OpenSSH bash commands. Familiarity with Wireshark is also essential.

"Error 403" plunges delegates into the adrenaline-fueled world of cybersecurity, where strategic thinking and technical mastery collide. As they unravel cryptographic puzzles and breach fortified defenses, delegates will experience the thrill of high-stakes problem-solving.

## STUDY RESOURCES

<a href="#">Information Documents</a>	<a href="#">Round 1</a>	<a href="#">Study Pack</a> <a href="#">Sample Code and Documentation</a> <a href="#">Python Libraries</a>
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Information Documents	Round 2	<a href="#">DMOJ Sample Questions</a>
Resources	Round 1 Round 2	<a href="#">Video Links</a> <a href="#">LeetCode</a> <a href="#">HackerRank</a>
	Round 3	<a href="#">Video Links</a>
Software (should be downloaded on device in advance)	Round 1	<a href="#">Python</a> <a href="#">PyCharm</a> <a href="#">VS Code</a> <a href="#">Anaconda</a>