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PAGE NO.
DATE / /

ASSIGNMENT - 3

a) A stochastic process is a mathematical concept that represents a collection of random variables indexed by some parameter.

Some applications of it in field of IT, AI and Data Science are :

- Natural Language Processing (NLP) : Stochastic processes play a role in language modelling & probabilistic approaches.
- Neural Modelling & Neuroscience : Stochastic processes are used to model neural firing patterns & brain activity.
- Pattern recognition in Image Processing : Stochastic processes help identify patterns and structures in images.
- Optimisation & Resource Management : Stochastic models optimise resource allocation in IT infrastructure, energy management in IoT systems.
- Risk Assessment in Financial Markets : They model financial asset price movement, assess risk and inform trading strategies in quantitative finance.

PAGE NO.
DATE / /

1) Sampling theory is a branch of statistics that deals with the methods and techniques used to collect & analyse data from a subset of a larger population.

Some applications of it in field of IT, AI and data science are :

- Machine learning and AI : It is used to select representative samples for model training to ensure generalisation to unseen data.
- Cybersecurity : Used for anomaly detection while analysing a sample of network traffic data to identify unusual patterns.
- IoT : Sampling is a core process in IoT systems. Determines the data volume circulating within the network.
- Digital Image Processing : It is primarily used in image compression and noise reduction.
- Big Data Analytics : It reduces computational load by analysing a subset of data to speed up processing and reduce resource requirement.

PAGE NO.
DATE / /

c) Hypothesis testing is a method of statistics used to decide whether the data at hand sufficiently support a particular hypothesis.

Some applications of it in field of IT, AI and data science are :

- A/B testing : Evaluates changes in algorithms, models or designs to determine if they lead to significant improvement in user engagement.

- Feature engineering in ML : Feature selection and engineering involve testing hypotheses about relevance and significance of different input variables.

- Experimental Design in AI research : Used in testing hypotheses about effectiveness of different neural network architectures.

- ML model evaluation : Used for assessing the performance of ML models, examples are hypothesis test.

- ~~Regression~~

- Systems monitoring : Analyses performance metrics to identify and rectify anomalies in hardware and software systems.