CHAPTER 10

ARTIFICIAL INTELLIGENCE & AUTOMATION

AI simulates human intelligence so machines can **learn, reason and solve problems**. **Intelligent Automation (IA)** combines AI with **RPA** to automate not only repetitive tasks but also **complex, cognitive processes** — end-to-end workflow automation. Covers the three types of AI (**Analytical, Predictive, Generative**) and **Agenting AI**.

CHAPTER ROADMAP

1 Artificial intelligence — cycle · 3 types
2 Generative AI algorithms — 5
3 Agenting AI — features · types · uses

DEFINITION

Artificial Intelligence (AI) refers to the simulation of human intelligence processes by machines, particularly computer systems.

Enables machines to perform tasks that typically require human intelligence — **problem-solving, perception, natural language understanding**. AI processes include **learning** (acquiring information and rules for using it), **reasoning** (using rules to reach conclusions) and **self-correction**.

1.1 AI LEARNING CYCLE

iterative

① **Data Collection** — relevant, high-quality data
› ② **Data Preprocessing** — clean, transform, organise
› ③ **Model Training** — algorithms learn from data
› ④ **Results Evaluation** — test on **unseen** data
› ⑤ **Model Deployment** — real-world use ↻

1.2 TYPES OF ARTIFICIAL INTELLIGENCE

by functionality

Analytical AI
past & present → insights

Analyses **historical data** to uncover patterns & insights for data-driven decisions. Uses **statistical methods, ML models, data mining**.

Uses: financial analysis, operational efficiency, **fraud detection**, supply-chain inventory optimisation.

e.g. Bank flags suspicious transaction patterns; retailer studies sales for peak periods & preferences.

Predictive AI
past data → future

Uses past data & algorithms to **predict future events, trends or outcomes**. Uses **regression, time-series analysis, ML**.

Uses: risk assessment, customer behaviour, market trends, **continuous monitoring/auditing**, credit risk.

e.g. E-commerce predicts next purchase; insurer sets premiums from behaviour & market conditions.

Generative AI
creates new content

Creates **new text, images, audio, video or code** by learning patterns from large datasets — similar but unique. Uses **GANs** & **transformers (GPT)**.

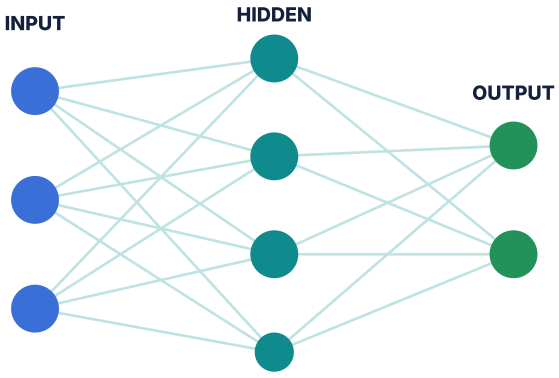
Uses: creative industries, automated reports, music, marketing, design; finance — **simulate market scenarios**.

e.g. Automated news from real-time financial data; new clothing designs from trends.

MEMORY HOOK **Analytical** looks **back** · **Predictive** looks **ahead** · **Generative creates** something new.

GA ALGORITHMS USED IN GENERATIVE AI

learn from data → generate similar but unique



① Neural Networks

Modelled loosely on the **human brain**; recognise patterns, classify data, learn from examples — powerful for **unstructured data** (images, text, audio). Layers of **neurons (nodes)** joined by **weights** adjusted during learning.

- **Input layer** — receives raw data / features
- **Hidden layers** — computations; extract patterns via weights & activation functions
- **Output layer** — final prediction / classification

How they learn — Backpropagation

i. Forward pass input → prediction › **ii. Loss calculation** predicted vs actual › **iii. Backward pass** adjust weights (gradient descent)

Repeated over multiple **epochs** until performance is acceptable.

Types of Neural Networks

FNN	Feedforward — data moves **one direction**, input → output
CNN	Convolutional — **images & spatial** data
RNN	Recurrent — **sequential** data (time series, language)
DNN	Deep — **many hidden layers**; foundation of deep learning

Uses: image & speech recognition · NLP (translation, chatbots) · fraud detection · medical diagnosis · autonomous vehicles

② GANs — Generative Adversarial Networks

Ian Goodfellow, 2014 · two networks in a zero-sum game

Generator creates synthetic data ⇄ **Discriminator** real or fake?

Adversarial process: trained simultaneously — generator gets more realistic, discriminator gets better at spotting fakes, until output can **fool** the discriminator.

- Image generation / deepfakes
- Video & audio synthesis
- Style transfer (photo → Van Gogh)

③ VAEs — Variational Autoencoders

single network · compress → reconstruct

Encoder compress input › **Latent space** compressed, abstract › **Decoder** reconstruct / generate

Learns the **probability distribution** of data. Unlike GANs (two opposing networks), uses **one network**.

- Image & video generation
- Data imputation (missing values)
- Anomaly detection

④ Transformer Models

revolutionised NLP · no RNNs

Self-attention weighs the importance of each word relative to others — sees the **entire sequence at once** → handles long-range dependencies. **Encoder–decoder**: encoder processes input, decoder generates output.

- Text generation (GPT)
- Translation (Google Translate)
- Summarisation

⑤ RNNs & LSTMs

sequential data · memory

Take **one input at a time**, updating **hidden states** from current input + previous state. **LSTM** = special RNN that retains information over **long sequences**.

- Speech & music generation
- Time-series forecasting
- Lyrics, poetry, code

Application	Algorithms (study text summary)	Application	Algorithms
Image generation	GANs, VAEs	Data simulation	VAEs, GANs
Text generation	Transformers, RNNs/LSTMs	Creative content	GANs, Transformers, LSTMs
Speech & audio	GANs, RNNs/LSTMs		

2 AGENTING AI

autonomous / intelligent agents

DEFINITION

Agenting AI (Autonomous / Intelligent Agents) refers to systems that operate autonomously within an environment to achieve specific goals.

Agents **perceive** surroundings, **make decisions** and **take actions** independently, often interacting with other agents/systems. Used where independent decision-making matters — **robotics, simulations, multi-agent systems (MAS)**.

Key Features

Autonomy
Operate **without human intervention**.

Goal-Oriented
Designed to achieve **specific objectives**.

Adaptability
Learn from experience; adjust strategies.

Interactivity
Cooperate with other agents, apps, users.

Perception & Action
Sense via **sensors / data**, act toward goals.

Types of Intelligent Agents — simplest → most capable

Agent type	How it decides	Study-text example
Simple Reflex	**Current perceptions only**; pre-defined rules; ignores past experience	Thermostat adjusting to current readings
Model-Based Reflex	Keeps an **internal model** of the world; current + **historical context**	Robot vacuum that **maps** the room to optimise its route
Goal-Based	Chooses actions that move toward a **specific goal**	**Self-driving cars** — lane detection, obstacle avoidance, traffic-aware routing, autonomous parking (computer vision, deep learning, LIDAR, radar, cameras)
Utility-Based	Picks action with the **highest expected utility** (short & long term)	Investment advisor maximising returns while considering risk
Learning	**Improves over time** from feedback & outcomes	Recommendation system learning a user's preferences

Applications

Robotics	Drones fly autonomously & avoid obstacles while delivering
Supply chain	Agents handle inventory, logistics, supplier coordination & talk to each other
Financial trading	Analyse trends, execute trades, optimise portfolios in real time
Smart homes	Control lights, thermostats, cameras; learn preferences
Game development	Realistic, adaptive **NPCs**

Benefits

- **Autonomy & decision-making** — no human intervention needed
- **Efficiency** — automates complex processes (supply chain, trading)
- **Scalability** — large, complex environments (manufacturing, finance, logistics)
- **Continuous learning** — learning agents get more accurate with experience

BIG PICTURE **AI, RPA, Intelligent Automation and Agenting AI** together enhance decision-making, automate complex processes and improve efficiency — driving productivity, accuracy and scalability.

! EXAM FOCUS · MCQ TRAPS

commonly confused points

1 IA vs RPA
RPA automates repetitive tasks; **IA = AI + RPA**, adding complex, cognitive processes.

2 Results evaluation
Model is tested on **unseen** data — not the training data.

3 Analytical vs Predictive
Fraud found in **past** transactions = Analytical. Predicting **default likelihood** = Predictive.

4 GAN vs VAE
GAN = **two** competing networks (generator vs discriminator). VAE = **one** network (encoder → latent space → decoder).

5 Who judges real vs fake?
The **discriminator**. The generator creates.

6 Transformers
Use **self-attention**, see the whole sequence at once — they do **not** rely on RNNs.

7 CNN vs RNN
CNN = **images / spatial**. RNN = **sequential** (time series, language). DNN = many hidden layers.

8 Backpropagation order
Forward pass → loss calculation → backward pass (gradient descent), over many **epochs**.

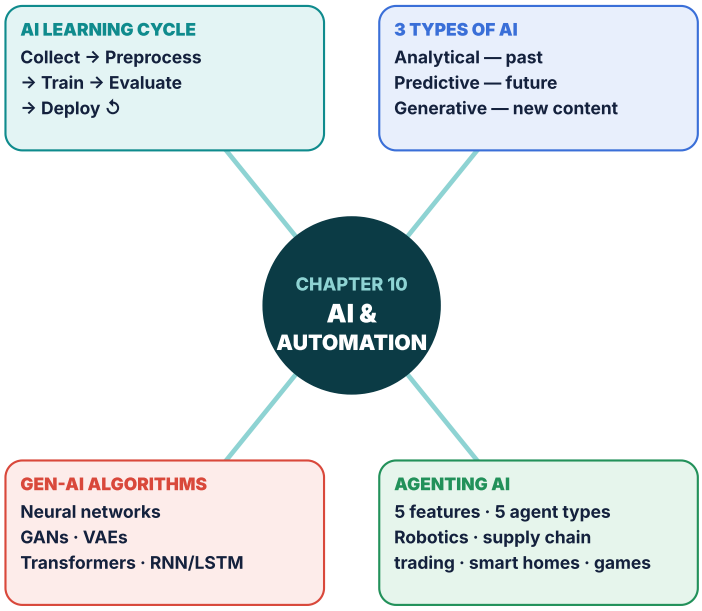
9 Reflex agents
Simple reflex = current input only (thermostat). Model-based = keeps a **map / internal model** (robot vacuum).

10 Utility vs goal
Goal-based reaches **a goal**; utility-based picks the **best-value** action among options.

CLASSIFY IT

1	Spot irregularities in last year's ledger	Analytical AI
2	Forecast next product a customer buys	Predictive AI
3	Auto-write a financial news report	Generative AI
4	Photo turned into Van Gogh style	GAN
5	Fill missing values in a dataset	VAE
6	Summarise a long document	Transformer
7	Room thermostat	Simple reflex
8	Self-driving car	Goal-based
9	Netflix-style recommendations improve	Learning agent

REVISION MAP



AI
Machines simulating learning, reasoning & self-correction.

IA
AI + RPA → cognitive, end-to-end automation.

3 Types
Analytical, Predictive, Generative.

Gen-AI engines
NN, GAN, VAE, Transformer, RNN/LSTM.

Agents
Autonomous, goal-oriented, adaptive.