**Artificial Intelligence**

**Session 2**

1. **Agent**: An agent is anything that perceives its environment through sensors, reasons about its goals, and acts upon that environment through actuators.
2. **Agent program structure (PEAS)**:
   1. **P**erformance measure: evaluate the actions of the agent based on the outcome.
   2. Environment: the domain in which it operates and with which it interacts
   3. Actuators: how an agent *acts* upon its environment.
   4. Sensors: how an agent *perceives* its environment.
3. **Types of agents**:  
   1. Simple reflex: interprets inputs (percepts) and matches with a pre-made rule catalogue.
   2. Agents with state: Maintain an internal state to keep track of more than one percept. This helps to distinguish between world states that generate the same perceptual input but are significantly different in terms of the actions that must be taken.
   3. Goal-based agents: Extension of agents with state. An agent program combines predefined goal information with information about the results of possible actions to choose actions that achieve the goal.
   4. Utility-based agents: Goal satisfaction provides a crude distinction between good states and bad states, whereas a more general performance measure would allow a comparison between states, or sequences of states, according to exactly how desirable they are. This measure of preference over world states is known as utility. Utility (usually) maps states onto real numbers so they are comparable.
4. **Phases** **to learn**:  
   1. Modelling: Creation of a model specifically for the ML problem.
   2. Inference: The model is put into action on live data to produce actionable output.
   3. Learning: Use new data to test out the validity of the output.
5. **Environments**:   
   1. *Fully* vs *partially* observable: Sensors provide input.
   2. *Deterministic*: next state completely determined by current state and agent action; *stochastic*: in stochastic environments next state is uncertain
   3. *Episodic*: agent’s experiences divided into episodes: agent perceives then acts. Quality of action depends only on the episode itself; *sequential*: subsequent episodes are independent of previous ones.
   4. *Dynamic*: environment may change while agent is deliberating; *static*: in a static environment an agent does not need to look at the world while deciding on an action, nor does it need to worry about the passage of time.
   5. *Discrete*: limited number of distinct, clearly defined percepts and actions; *continuous*: infinitesimally changing.

The real world is partially observable, stochastic, sequential, dynamic, continuous, and multi-agent.