



Evaluation – November 2023

Examples of possible answers

[Q1]. Explain why different experiments with the same emerging phenomenon may show significantly varying outcomes. Give an example.

Many collective systems show varying emerging behaviour because random fluctuations get amplified. Example: ants in the double bridge experiment end up using either one branch of the bridge or the other.

[Q2]. Why do most "real-life" networks have a small diameter?

Real-life networks are constructed. Mechanisms such as preferential attachment lead to the emergence of hubs. Any two points in the network are indirectly linked through a short path due to the presence of hubs.

[Q3]. Describe the technique of "Phenotypic sharing". Provide an example.

Phenotypic sharing is used in genetic algorithms to promote exploration over exploitation. It consists in penalizing solutions that are too much alike. Example: use of poison in the labyrinth problem.

[Q4]. What is the exploration/exploitation dilemma? Explain and illustrate with a couple of examples.

Exploitation consists of sticking to a resource/solution known to be relatively good. Exploration consists of quitting that resource/solution in the hope of finding a possibly better one. Example 1: number of ants exploiting known food sources vs. ants randomly foraging. Example 2: returning to a known individual to play cooperative game vs. picking a new partner at random.

[Q5]. In some species (typically birds), individuals form a mob and take risks to deter a predator (e.g. circling a snake or harassing a falcon). Can you think of an evolutionary explanation for such behaviour?

According to Amotz Zahavi, these individuals take risk to advertise their bravery. In this interpretation, the predator is an excuse to show off in front of an "audience" (other individuals). This logic makes sense in a context in which individuals choose each other according to a given quality (here, bravery) and benefit from being chosen.

[Q6]. Why is iterated cooperation (based on the prisoner's dilemma) unstable when individuals can choose whom to interact with?

Because of the exploration/exploitation dilemma. When most people cooperate, it is in the interest of individuals to pick unknown individuals (as the risk is low).