ABSTRACTION AND MODELLING

TRUE OR FALSE Mark the following statements as true (T) or false (F):

1. Abstraction is the process of adding details to a problem to make it easier to solve.
2. A metro map is an example of an abstraction.
3. Dynamic models represent a system at a single point in time.
4. Abstraction involves preserving relevant details and ignoring irrelevant ones.
5. A directed graph is always a static model.
6. Leaky abstractions occur when hidden details unexpectedly influence the system.
7. A computer email system is not an abstraction since it represents the real world exactly.
8. Models help in understanding problems by simplifying complex systems.
9. The main purpose of modelling is to create an exact replica of reality.
10. Precision refers to how close a measurement is to the true value, while accuracy is about the level of detail in measurement.

MULTIPLE CHOICE QUESTIONS Choose the correct answer for each question.

1. What is the primary purpose of abstraction in computational thinking?

   a) To include as many details as possible

   b) To simplify a complex system by removing irrelevant details

   c) To increase the complexity of a problem

   d) To avoid solving problems

2. Which of the following is NOT an example of abstraction?

   a) A metro map

   b) A photograph of a city

   c) A simplified mathematical model of climate change

   d) A stick figure drawing of a person

3. What differentiates a dynamic model from a static model?

   a) A dynamic model changes over time, while a static model does not

   b) A static model is more detailed than a dynamic model

   c) A dynamic model is always more accurate than a static model

   d) A static model includes more entities than a dynamic model

4. Which of the following is a common issue with abstraction?

   a) It always results in perfect models

   b) It can oversimplify and miss crucial details

   c) It eliminates the need for problem-solving

   d) It always leads to incorrect conclusions

5. In a rental car system, which level of abstraction is the most general?

   a) A specific car with a license plate number

   b) A category of cars based on fuel type

   c) The concept of a vehicle

   d) A customer's rental history

6. What is a common use of models in computational thinking?

   a) To make a problem more complicated

   b) To visualize and understand the relationships between entities

   c) To replace all human decision-making

   d) To eliminate the need for software development

7. Which of the following statements about layers of abstraction is correct?

   a) Each layer adds more complexity without reducing details

   b) Lower layers contain more general concepts

   c) Higher layers suppress more details and provide a broader view

   d) There are only two layers of abstraction in any system

8. What do 'entities' represent in a model?

   a) The relationships between different objects

   b) The core concepts or objects within a system

   c) The rules governing a system

   d) The graphical representation of a system

9. In a state machine diagram for an online shopping order, which of the following is NOT a valid state?

a) Order placed

b) Order being processed

c) Order teleported

d) Order dispatched

10. Why are models useful in computer science?

a) They allow for efficient problem-solving by simplifying reality

b) They eliminate the need for abstraction

c) They always represent reality with perfect accuracy

d) They increase the complexity of systems unnecessarily

MULTIPLE MATCHING QUESTIONS Match the concepts in Column A with their correct definitions in Column B.

Column A

1. Abstraction
2. Static Model
3. Dynamic Model
4. Entity
5. Relationship
6. Layers of Abstraction
7. Leaky Abstraction
8. Modelling
9. Precision
10. Accuracy

Column B

A. The act of representing essential details while ignoring irrelevant ones.
B. A model that represents a system at a single point in time.
C. A model that shows how a system changes over time.
D. A core concept or object within a system.
E. A connection that links entities within a system.
F. The process of structuring concepts at different levels of detail.
G. A situation where hidden details unexpectedly affect a system.
H. The process of creating representations to analyze and solve problems.
I. The level of refinement in measurement.
J. The closeness of a measurement to the true value.

COMPREHENSION QUESTIONS FOR CLASSROOM DISCUSSION

1. Why is abstraction important in computational thinking?

2. How does a metro map serve as an abstraction?

3. What is the main difference between static and dynamic models?

4. How can leaky abstractions impact a system?

5. Why do models not always represent reality with perfect accuracy?

6. What role do layers of abstraction play in problem-solving?

7. How can modelling help in understanding complex systems?

8. Give an example of a real-world situation where abstraction is useful.

9. Why is precision different from accuracy in computational models?

10. How does a state machine diagram represent different system states?

KEYS

TRUE OR FALSE

1. **F** – Abstraction removes details to simplify a problem, not add them.
2. **T** – A metro map is a simplified representation of reality.
3. **F** – Dynamic models show changes over time, while static models do not.
4. **T** – Abstraction keeps relevant details and ignores irrelevant ones.
5. **F** – A directed graph can represent both static and dynamic models.
6. **T** – Leaky abstractions occur when hidden details unexpectedly affect a system.
7. **F** – Email is an abstraction of communication, simplifying technical details.
8. **T** – Models help simplify complex systems for better understanding.
9. **F** – Models do not create exact replicas but rather useful representations.
10. **F** – Accuracy refers to closeness to the true value, while precision is about refinement.

MULTIPLE CHOICE QUESTIONS

1. **b)** – Abstraction simplifies a system by removing irrelevant details.
2. **b)** – A photograph is a direct representation, not an abstraction.
3. **a)** – Dynamic models change over time, static models do not.
4. **b)** – Abstractions can oversimplify and miss crucial details.
5. **c)** – "Vehicle" is the most general level of abstraction.
6. **b)** – Models help visualize and understand relationships between entities.
7. **c)** – Higher layers suppress more details for a broader view.
8. **b)** – Entities represent the core concepts or objects in a system.
9. **c)** – "Order teleported" is not a valid state in an online shopping system.
10. **a)** – Models simplify reality to enable efficient problem-solving.

MULTIPLE MATCHING QUESTIONS

1. **Abstraction → A** (The act of representing essential details while ignoring irrelevant ones.)
2. **Static Model → B** (A model that represents a system at a single point in time.)
3. **Dynamic Model → C** (A model that shows how a system changes over time.)
4. **Entity → D** (A core concept or object within a system.)
5. **Relationship → E** (A connection that links entities within a system.)
6. **Layers of Abstraction → F** (The process of structuring concepts at different levels of detail.)
7. **Leaky Abstraction → G** (A situation where hidden details unexpectedly affect a system.)
8. **Modelling → H** (The process of creating representations to analyze and solve problems.)
9. **Precision → I** (The level of refinement in measurement.)
10. **Accuracy → J** (The closeness of a measurement to the true value.