Q1. Should a learning-based or model-based approach be used in each of the following case? Justify your answer with max two bullet points.

a. An airport security system must identify and verify passengers' faces against a database of authorized individuals.

Answer: Learning-based – Facial recognition relies on deep learning models trained on large datasets to accurately match faces under different lighting and angles.

b. A company develops a system to scan and verify printed circuit boards (PCBs) for missing components using computer vision.

Answer: Model-Based:

Edge detection, template matching, and contour analysis can accurately identify missing components based on predefined rules.

Training a deep learning model requires a large dataset with defective and non-defective examples.

Minor variations in lighting or manufacturing can lead to false positives or negatives in a learning-based model.

Q2. A pinhole camera is used to capture the image of a 3D object placed in front of it. The object Height: 10 cm and Width: 5 cm. Camera focal length: 10 cm

You want the captured image to have a height that is exactly half of the object's actual height. At what distance Z should the object be placed from the pinhole camera to achieve this?

Answer:

Using the pinhole camera projection formula:

$$Y' = (f/Z) * Y$$

Substituting the values:

$$5 = (10/Z) \times 10$$

Solving for Z:

$$Z = 10 \times 10 / 5 = 20 \text{ cm}$$

Thus, the object should be placed 20 cm away from the pinhole camera to capture an image that is exactly half its original height.