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SCO INTERNATIONAL ARTIFICIAL INTELLIGENCE OLYMPIAD

CLASS 9 SAMPLE QUESTION PAPER

A comprehensive document for schools, teachers, parents, and students

Designed from Class 9 AI pathways and aligned with SCO's guided preparation, practice, reporting, and future-ready AI literacy.

- age-fit AI, machine learning, NLP, Python, ethics, and application-based reasoning for Class 9 learners globally
- professionally formatted question paper with compact question-number tags, answer key, and explanations
- ready for school, teacher, parent, and student use as a website/PDF learning resource

AI	Machine Learning	NLP	Python	Applications
Data	Logic	Fairness	Capstone	Practice

Paper Overview

Exam Name	SCO International Artificial Intelligence Olympiad
Class / Grade	Class 9 / Grade 9
Question Paper Set	Set S
Total Questions	50 multiple-choice questions
Duration	60 minutes
Question Type	Objective type with one correct answer
Sections	General Questions and Achievers Section
Use	Website sample paper, classroom practice, and guided preparation

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Candidate Instructions

- Read every question carefully before marking the answer.
- There is only one correct answer for each multiple-choice question.
- Calculators, mobile phones, and digital aids are not allowed unless specifically permitted by the examination authority.
- Use the question paper for rough reading only; answers must be marked as instructed by the invigilator or online system.
- Passages, code snippets, and case details are part of the question block and should be read fully before choosing an option.
- This document includes the answer key and explanations for guided learning and website sample-paper use.

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Section A: General Questions

Q.1 A convolutional neural network (CNN) has the following layers:

Input layer: 128 x 128 x 3

Convolution layer: 32 filters, kernel size = 3x3, stride = 1, padding = "same"

MaxPooling layer: Pool size = 2x2, stride = 2

What is the output size of the MaxPooling layer?

A. 64 × 64 × 32

B. 126 × 126 × 32

C. 128 × 128 × 32

D. 62 × 62 × 32

Answer: **A**

Explanation: With padding "same", the convolution output remains 128 x 128 and 32 filters create 32 channels. Max pooling with pool size 2 and stride 2 halves the spatial size to 64 x 64, so the output is 64 x 64 x 32.

Q.2 A recurrent neural network (RNN) faces the issue of vanishing gradients. Which of the following techniques addresses this problem effectively?

A. Dropout regularization

B. Using rectified linear units (ReLU)

C. Gradient clipping

D. Long Short-Term Memory (LSTM) networks

Answer: **D**

Explanation: LSTM networks use gated memory cells that help retain long-term information and reduce the vanishing-gradient problem in sequence learning.

Q.3 You are training a neural network and notice that the loss decreases initially but stabilizes at a high value. What could be the most probable issue?

A. The model is underfitting the data.

B. The learning rate is too high.

C. The activation function is incorrect.

D. There is no regularization in the model.

Answer: **A**

Explanation: A loss that falls slightly but remains high usually means the model is not learning enough useful patterns, which is a sign of underfitting.

Q.4 In an autonomous robot using AI and IoT, which of the following best describes how AI enhances IoT data processing?

A. AI ensures secure data transmission over IoT networks.

B. AI preprocesses IoT data for noise removal and missing values.

C. AI analyzes IoT data for real-time decision-making.

D. AI helps reduce IoT device battery consumption.

Answer: **C**

Explanation: AI adds intelligence to IoT systems by analyzing sensor data and supporting real-time decisions such as alerts, control, or prediction.

Q.5 An AI-integrated IoT system detects abnormal behavior in a smart factory's machines using predictive maintenance algorithms. Which of the following models is most suitable for this task?

A. Logistic regression
B. K-means clustering
C. LSTM networks
D. Decision trees

Answer: C

Explanation: Predictive maintenance often uses time-series sensor data. LSTM networks are suitable because they can learn patterns over time.

Q.6 Which error in IoT and robotics applications is most commonly introduced due to faulty sensor calibration?

A. Feature scaling error
B. Measurement noise
C. Overfitting error
D. Hyperparameter mismatch

Answer: B

Explanation: Faulty calibration causes sensor readings to deviate from true values, producing measurement noise or systematic measurement error.

Q.7 In training an AI system, you observe a significant bias in predictions for a minority group. What step should you take first to address the issue?

A. Increase the training dataset size.
B. Balance the dataset with more samples from the minority group.
C. Use a different activation function in the neural network.
D. Reduce the learning rate.

Answer: B

Explanation: The first step is to improve representation by adding or balancing minority-group samples so the model learns more fairly from the data.

Q.8 Which of the following is an example of creating an ethical AI system?

A. Using adversarial attacks to test model robustness.
B. Designing AI systems that prioritize transparency and interpretability.
C. Applying aggressive data augmentation techniques.
D. Training models on extremely large datasets.

Answer: B

Explanation: Transparency and interpretability help people understand AI decisions, which is central to responsible and ethical AI design.

Q.9 In an object detection project using YOLOv5, you notice that small objects are often missed. Which solution would most likely improve detection performance?

A. Increase batch size during training.
B. Decrease the IoU threshold.
C. Use higher-resolution images.
D. Apply dropout regularization.

Answer: C

Explanation: Small objects occupy very few pixels. Higher-resolution images make the objects clearer and usually improve detection.

Q.10 A chatbot struggles to respond accurately to context-based questions. What modification would most effectively address this issue?

A. Replace the chatbot's model with a Transformer-based model.
B. Increase the chatbot's dataset size.
C. Add more layers to the model.
D. Decrease the model's training epochs.

Answer: A

Explanation: Transformer-based models handle context better than simple sequence or rule-based models, making them stronger for context-dependent chatbot responses.

Q.11 In OpenCV, which operation is used to highlight the edges of objects in an image?

A. Gaussian blur
B. Edge detection using the Canny method
C. Image thresholding
D. Morphological dilation

Answer: B

Explanation: Canny edge detection is a common OpenCV method for detecting strong edges after noise reduction and gradient analysis.

Q.12 Which Python library is most suited for building and training convolutional neural networks?

A. NumPy
B. Scikit-learn
C. TensorFlow
D. Matplotlib

Answer: C

Explanation: TensorFlow/Keras is widely used for building and training convolutional neural networks for image tasks.

Q.13 You are training a CNN, and during backpropagation, you notice that the weights in the first few layers are not updating. What is the most probable cause?

A. High learning rate
B. Exploding gradients
C. Vanishing gradients
D. Poor weight initialization

Answer: C

Explanation: If early layers stop receiving useful gradients, their weights may barely update. This is a classic symptom of vanishing gradients.

Q.14 While training a neural network, the validation loss decreases initially but later starts increasing, even as training loss continues to decrease. What issue is the model facing?

A. Underfitting
B. Overfitting
C. Vanishing gradients
D. Exploding gradients

Answer: B

Explanation: Training loss falling while validation loss rises means the model is fitting the training data too closely and generalizing poorly.

Q.15 A CNN is producing poor results on image classification tasks. Upon investigation, you find that the activation maps are too sparse. What could be the cause?

A. Too many convolutional layers
B. Using ReLU as the activation function
C. Large kernel size
D. Excessive dropout

Answer: D

Explanation: Excessive dropout can make activations too sparse and prevent the model from preserving enough useful feature information.

Q.16 Which of the following statements about convolutional layers in CNNs is true?

A. Convolutional layers are invariant to rotation of input features.
B. Increasing the stride in a convolutional layer decreases the size of the feature map.
C. Padding with "valid" mode preserves the spatial dimensions of the input.
D. Increasing the number of convolutional filters reduces the spatial size of the feature map.

Answer: B

Explanation: Increasing stride moves the filter by larger steps, so fewer output positions are computed and the feature map becomes smaller.

Q.17 A deep RNN is struggling with learning long-term dependencies. Which approach is most suitable to address this issue?

A. Adding more layers to the RNN
B. Using LSTM or GRU cells instead of standard RNN cells
C. Applying Batch Normalization to all hidden states
D. Reducing the size of the training dataset

Answer: B

Explanation: LSTM and GRU cells are designed to capture longer-term dependencies better than standard RNN cells.

Q.18 Given an image classification task with an imbalanced dataset, what modification would likely result in the most robust CNN performance?

A. Increase the kernel size of the convolutional layers
B. Use a weighted loss function to penalize misclassifications of minority classes
C. Add more fully connected layers to the model
D. Use Dropout to prevent overfitting

Answer: B

Explanation: A weighted loss function gives more penalty to minority-class errors, helping the CNN learn from imbalanced data more robustly.

Q.19 You are training a CNN and notice that the validation accuracy is consistently lower than training accuracy. Which technique is the least effective in resolving this issue?

A. Applying data augmentation
B. Using regularization techniques such as Dropout
C. Adding Batch Normalization layers
D. Increasing the number of filters in the convolutional layers

Answer: D

Explanation: Increasing filters may make the model larger and could worsen overfitting; regularization, augmentation, and normalization are more directly useful.

Q.20 You are working on a real-world project that uses CNNs for medical image segmentation. The Dice coefficient on the validation set is low. Which approach would most likely improve performance?

A. Use a smaller batch size during training
B. Replace ReLU with Sigmoid as the activation function in convolutional layers
C. Train the network with a U-Net architecture
D. Reduce the number of pooling layers in the network

Answer: C

Explanation: U-Net is a well-known architecture for medical image segmentation because it combines localization with deep feature learning.

Q.21 Which of the following is a primary challenge when integrating AI with IoT for smart device applications?

A. High bandwidth requirements for edge computing
B. Lack of sufficient IoT devices to collect data
C. Over-reliance on supervised learning methods
D. Difficulty in integrating IoT sensors with AI models

Answer: D

Explanation: A key practical challenge is integrating many sensor streams with AI models reliably under real-world noise, latency, and device constraints.

Q.22 In the context of autonomous navigation for robotics, what is the role of the SLAM (Simultaneous Localization and Mapping) algorithm?

A. Enhancing energy efficiency of IoT devices in real-time environments
B. Enabling a robot to map an unknown environment while keeping track of its position
C. Training deep learning models for object recognition tasks
D. Improving communication between distributed IoT systems

Answer: B

Explanation: SLAM enables a robot to build a map of an unknown environment while simultaneously estimating its own location.

Q.23 A robot designed for warehouse management must optimize its path while avoiding obstacles in real-time. Which AI approach is most suitable for this task?

A. Convolutional Neural Networks (CNNs)
B. Reinforcement Learning (RL)
C. Generative Adversarial Networks (GANs)
D. Unsupervised Clustering

Answer: B

Explanation: Reinforcement learning is suitable for path optimization and obstacle avoidance because an agent learns actions from rewards in an environment.

Q.24 What is the primary advantage of implementing Federated Learning in AI-enabled IoT systems?

A. Reduces hardware requirements for IoT devices
B. Eliminates the need for labeled training data
C. Preserves data privacy by training models locally on devices
D. Improves the performance of cloud-based AI models

Answer: C

Explanation: Federated learning allows models to train locally on devices and share model updates instead of raw data, improving privacy.

Q.25 In an AI-powered robotic arm used for assembly tasks, which sensor type is critical for detecting the force applied during operations?

A. Infrared sensors
B. LiDAR sensors
C. Tactile sensors
D. Ultrasonic sensors

Answer: C

Explanation: Tactile or force sensors are used to detect physical contact and force applied by robotic arms during manipulation.

Q.26 Which of the following approaches is most effective in mitigating AI bias caused by underrepresented groups in training data?

A. Using larger datasets without modifying their composition
B. Implementing transfer learning from biased datasets
C. Using synthetic data to supplement underrepresented groups
D. Increasing the number of layers in the neural network

Answer: C

Explanation: Synthetic data can supplement underrepresented groups and improve model exposure to diverse examples when collected data is imbalanced.

Q.27 Which principle is NOT part of responsible AI development?

A. Ensuring transparency in AI decision-making processes
B. Prioritizing the maximization of model accuracy over fairness
C. Enforcing accountability for AI outcomes
D. Incorporating sustainability in AI system design

Answer: B

Explanation: Responsible AI should not maximize accuracy at the expense of fairness; fairness, transparency, accountability, and sustainability matter.

Q.28 An AI system designed for loan approval shows systematic bias against certain demographics. What is the best immediate step to address this issue?

A. Discard the biased model and start training from scratch
B. Add more features to the model for better accuracy
C. Perform a fairness audit and adjust the training dataset
D. Increase the model's complexity to better generalize

Answer: C

Explanation: A fairness audit identifies where the model is biased, and data/model adjustments can then target the actual source of unfairness.

Q.29 How can sustainability be incorporated into the design of AI systems?

A. Optimizing computational efficiency to reduce energy consumption
B. Increasing model size for better accuracy
C. Training models on cloud platforms with no energy constraints
D. Using high-power GPUs for faster training

Answer: A

Explanation: Efficient algorithms, smaller models, and optimized computation reduce energy use and support Green AI.

Q.30 Which of the following frameworks can help ensure ethical considerations are consistently applied in AI projects?

A. Agile methodology
B. ISO/IEC 27001 for Information Security
C. IEEE Ethically Aligned Design (EAD) framework
D. Six Sigma for quality improvement

Answer: C

Explanation: IEEE Ethically Aligned Design is specifically focused on embedding ethical considerations into autonomous and intelligent systems.

Q.31 Which of the following techniques is best suited for improving the accuracy of an object detection model in a capstone project?

A. Using a pre-trained object detection model like YOLO or Faster R-CNN
B. Increasing the dataset size by adding random images
C. Training a CNN from scratch without transfer learning
D. Applying k-means clustering to reduce noise in the dataset

Answer: A

Explanation: Using a pre-trained detector such as YOLO or Faster R-CNN transfers learned visual features and improves object-detection accuracy with less data.

Q.32 In an AI healthcare project for diagnosing diseases, which metric is most critical to evaluate the model's performance?

A. Accuracy
B. Precision
C. Recall
D. F1-Score

Answer: C

Explanation: In disease diagnosis, recall is critical because missing actual positive cases can be dangerous.

Q.33 While building a chatbot for customer support, what is the primary advantage of using a transformer-based model like GPT over a rule-based chatbot?

A. It requires no training data
B. It can understand context and generate human-like responses
C. It has lower computational costs
D. It eliminates the need for a conversational dataset

Answer: B

Explanation: Transformer models can use context across a conversation and generate flexible, human-like responses, unlike rigid rule-based chatbots.

Q.34 Which type of neural network is most appropriate for designing a real-time object detection system in a self-driving car capstone project?

A. Recurrent Neural Networks (RNNs)
B. Convolutional Neural Networks (CNNs)
C. Generative Adversarial Networks (GANs)
D. Transformer Networks

Answer: B

Explanation: CNNs are the core neural network type for extracting visual features used in real-time object detection systems.

Q.35 In an AI capstone project involving sentiment analysis for chatbot improvement, which preprocessing step is most critical for handling input text?

A. Normalizing pixel values
B. Tokenizing and removing stopwords
C. Applying Fourier transforms
D. Scaling numerical values to a specific range

Answer: B
Explanation: For sentiment analysis, text must first be split into tokens and cleaned so that words can be analyzed by the model.

Q.36 In OpenCV, which function is most commonly used for edge detection, and what is its key advantage?

A. cv2.HoughLines(); it accurately detects circular edges
B. cv2.Canny(); it reduces noise and detects strong edges
C. cv2.Laplacian(); it computes gradients across all directions
D. cv2.findContours(); it detects object boundaries efficiently

Answer: B
Explanation: cv2.Canny() is commonly used for edge detection; it reduces noise and identifies strong edges through a multi-stage process.

Q.37 When designing a CNN for image classification, what is the purpose of adding pooling layers, such as max pooling?

A. To increase the number of parameters in the network
B. To reduce the spatial dimensions of feature maps
C. To prevent overfitting during training
D. To convert the input data into grayscale

Answer: B
Explanation: Pooling layers reduce the height and width of feature maps, lowering computation while retaining important features.

Q.38 Which Python library is most suitable for performing data augmentation in deep learning projects, and what is one of its common techniques?

A. NumPy; element-wise operations
B. Matplotlib; plotting transformed data
C. TensorFlow/Keras; image flipping and rotation
D. Pandas; tabular data reshaping

Answer: C
Explanation: TensorFlow/Keras provides image preprocessing and augmentation utilities such as flipping, rotation, shifting, and zooming.

Q.39 In OpenCV, what is the output of the cv2.findContours() function, and how can it be used in object detection?

A. A list of contour points; it helps identify object shapes in an image
B. A heatmap of detected objects; it highlights regions of interest
C. A set of bounding boxes; it directly detects object locations
D. A binary mask of the image; it filters out noise

Answer: A
Explanation: findContours returns contour point lists that describe object boundaries and can be used to identify shapes.

Q.40 When implementing a CNN using Keras, which activation function is most commonly used in hidden layers, and why?

A. Sigmoid; it prevents vanishing gradients

B. Tanh; it ensures values remain centered around zero

C. ReLU; it introduces non-linearity and avoids vanishing gradients

D. Softmax; it normalizes output for classification

Answer: C

Explanation: ReLU is commonly used in hidden layers because it introduces non-linearity and reduces vanishing-gradient issues compared with saturated activations.

Section B: Achievers Section

Q.41 Which of the following decorators in Python is used to define a class method?

A. @staticmethod

B. @classmethod

C. @property

D. @abstractmethod

Answer: B

Explanation: @classmethod defines a method that receives the class as the first argument rather than an object instance.

Q.42 What will be the output of the following code snippet?

```
def func(a, b=[]):
b.append(a)
    return b
print(func(1))
print(func(2))
```

A. [1], [2]

B. [1], [1, 2]

C. [1, 2], [1, 2]

D. Raises an error

Answer: B

Explanation: The default list argument is shared across calls, so the second call appends 2 to the same list that already contains 1.

Q.43 In Python's multiprocessing module, which method is used to share data between processes?

A. Queue

B. Lock

C. Array

D. Manager

Answer: D

Explanation: A multiprocessing Manager can create shared objects such as shared lists or dictionaries that multiple processes can access.

Q.44 What does the following generator expression produce?

```
gen = (x**2 for x in range(3))
print(next(gen))
print(next(gen))
print(next(gen))
print(next(gen))
```

A. 0, 1, 4, StopIteration

B. 1, 4, StopIteration

C. Raises TypeError

D. 0, 1, 4, None

Answer: A

Explanation: The generator produces 0, then 1, then 4. A fourth next() call raises StopIteration because the generator is exhausted.

Q.45 What is the purpose of the zip_longest() function in the itertools module?

A. To combine two iterables, truncating to the length of the shorter iterable

B. To combine two iterables, filling missing values with a specified value

C. To create combinations of elements from two iterables

D. To merge two sorted iterables

Answer: B

Explanation: zip_longest combines iterables and fills missing values when one iterable is shorter than the other.

Q.46 Which Python standard library module can be used to work with low-level file descriptors?

A. os

B. io

C. sys

D. fileinput

Answer: A

Explanation: The os module provides functions for low-level operating-system interfaces including file descriptors.

Q.47 What is the primary difference between is and == in Python?

A. is checks for equality, while == checks for object identity

B. is checks for object identity, while == checks for equality

C. Both perform the same operation

D. is is used only for strings

Answer: B

Explanation: is checks whether two references point to the same object; == checks whether their values are equal.

Q.48 What does the following Python code do?

```
import collections
Counter = collections.Counter
data = [1, 2, 2, 3, 3, 3]
result = Counter(data).most_common(2)
print(result)
```

A. Prints the two most common elements in the list

B. Sorts the list in descending order

C. Removes duplicates from the list

D. Raises a TypeError

Answer: A

Explanation: Counter(data).most_common(2) returns the two most frequent values and their counts.

Q.49 What will be the output of the following Python code?

```
class A:
def __init__(self):
self.x = 1
class B(A):
def __init__(self):
super().__init__()
self.y = 2
b = B()
print(b.x, b.y)
```

A. Raises an AttributeError

B. 1, 2

C. None, 2

D. 0, 2

Answer: B

Explanation: B calls the parent constructor through super().__init__(), setting x = 1, and then sets y = 2.

Q.50 Which of the following Python constructs is used to handle errors during code execution?

A. assert

B. try...except

C. raise

D. del

Answer: B

Explanation: try...except catches and handles errors raised during program execution.

Consolidated Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	A	**2**	D	**3**	A	**4**	C	**5**	C
6	B	**7**	B	**8**	B	**9**	C	**10**	A
11	B	**12**	C	**13**	C	**14**	B	**15**	D
16	B	**17**	B	**18**	B	**19**	D	**20**	C
21	D	**22**	B	**23**	B	**24**	C	**25**	C
26	C	**27**	B	**28**	C	**29**	A	**30**	C
31	A	**32**	C	**33**	B	**34**	B	**35**	B
36	B	**37**	B	**38**	C	**39**	A	**40**	C
41	B	**42**	B	**43**	D	**44**	A	**45**	B
46	A	**47**	B	**48**	A	**49**	B	**50**	B

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