```
# Q4: Implementation – Many-to-One LSTM Model in Keras
import numpy as np
from tensorflow.keras.preprocessing.text import Tokenizer
from tensorflow.keras.preprocessing.sequence import pad_sequences
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Embedding, LSTM, Dense

# Data
sentences = ["I love pizza", "I hate rain", "You are amazing"]
labels = [1, 0, 1]  # 1 = Positive, 0 = Negative

# Tokenize
tokenizer = Tokenizer()
tokenizer.fit_on_texts(sentences)
sequences = tokenizer.texts_to_sequences(sentences)
word_index = tokenizer.word_index

# Pad sequences
max_len = max(len(seq) for seq in sequences)
X = pad_sequences(sequences, maxlen=max_len, padding='post')
y = np.array(labels)

# Model
vocab_size = len(word_index) + 1
model = Sequential([
    Embedding(input_dim=vocab_size, output_dim=8, input_length=max_len),
    LSTM(16),
    Dense(1, activation='sigmoid')
])

model.compile(optimizer='adam', loss='binary_crossentropy', metrics=['accuracy'])
model.summary()

# Train
model.fit(X, y, epochs=20, verbose=1)

# Evaluate
loss, accuracy = model.evaluate(X, y)
print(f"Training Accuracy: {accuracy:.2f}")
```

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/usr/local/lib/python3.11/dist-packages/keras/src/layers/core/embedding.py:90: UserWarning: Argument `input_length` is deprecated. Just
  warnings.warn(
```

Model: "sequential"

Layer (type)	Output Shape	Param #
embedding (Embedding)	?	0 (unbuilt)
lstm (LSTM)	?	0 (unbuilt)
dense (Dense)	?	0 (unbuilt)

Total params: 0 (0.00 B)
Trainable params: 0 (0.00 B)
Non-trainable params: 0 (0.00 B)

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Epoch 1/20
1/1 ━━━━━━━━━━━━━━━━━━━━ 4s 4s/step - accuracy: 0.6667 - loss: 0.6923
Epoch 2/20
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 207ms/step - accuracy: 1.0000 - loss: 0.6914
Epoch 3/20
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 134ms/step - accuracy: 1.0000 - loss: 0.6905
Epoch 4/20
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 142ms/step - accuracy: 0.6667 - loss: 0.6895
Epoch 5/20
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 69ms/step - accuracy: 0.6667 - loss: 0.6886
Epoch 6/20
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 144ms/step - accuracy: 0.6667 - loss: 0.6876
Epoch 7/20
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 128ms/step - accuracy: 0.6667 - loss: 0.6867
Epoch 8/20
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 143ms/step - accuracy: 0.6667 - loss: 0.6857
Epoch 9/20
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 148ms/step - accuracy: 0.6667 - loss: 0.6847
Epoch 10/20
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 141ms/step - accuracy: 0.6667 - loss: 0.6837
Epoch 11/20
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 164ms/step - accuracy: 0.6667 - loss: 0.6827
Epoch 12/20
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 98ms/step - accuracy: 0.6667 - loss: 0.6816
Epoch 13/20
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 93ms/step - accuracy: 0.6667 - loss: 0.6806
Epoch 14/20
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