Content created using ChatGPT ⋯

Below are **complete Week-1 additions** for the Coursera *Machine Learning* course, exactly as requested:

- 🧮 **Numerical solved examples**
- 🧑‍💻 **Python code (Week-1 level)**
- 📊 **Exam questions with answers**

All content matches **Week 1 scope** (Supervised Learning + Linear Regression basics).

🧮 PART 1: NUMERICAL SOLVED EXAMPLES (WEEK 1)

✅ Example 1: Simple Linear Regression Prediction

Problem

A dataset shows the relationship between **house size (x)** and **price (y)**.

x (size in 1000 sq.ft)	y (price in $1000)
1	300
2	500

Assume the hypothesis:

$$h_\theta(x) = \theta_0 + \theta_1 x$$

Given:

- $\theta_0 = 100$
- $\theta_1 = 200$

Find

Predict price for a house of size **x = 1.5**

Solution

$$h_\theta(1.5) = 100 + 200(1.5)$$

$$= 100 + 300 = 400$$

✅ Answer

Predicted price = **$400,000**

✅ Example 2: Cost Function Calculation (MSE)

Problem

Given:

- $h_\theta(x) = 100 + 200x$
- Training data:

x	y
1	300
2	500

Cost Function

$$J(\theta) = \frac{1}{2m} \sum (h_\theta(x^{(i)}) - y^{(i)})^2$$

Step 1: Predictions

- $h(1) = 300$
- $h(2) = 500$

Step 2: Errors

- $(300 - 300)^2 = 0$
- $(500 - 500)^2 = 0$

Step 3: Cost

$$J = \frac{1}{2(2)}(0 + 0) = 0$$

✅ Answer

Cost = **0** (perfect model)

✅ Example 3: One Step of Gradient Descent

Given

- $\theta_0 = 0, \theta_1 = 0$
- Learning rate $\alpha = 0.1$
- One data point: $x = 1, y = 2$

Gradient Descent Update

$$\theta_1 := \theta_1 - \alpha(h(x) - y)x$$

Compute

- $h(x) = 0$
- Error = $0 - 2 = -2$

$$\theta_1 := 0 - 0.1(-2)(1) = 0.2$$

✅ Answer

Updated $\theta_1 = 0.2$

🧑‍💻 PART 2: PYTHON CODE (WEEK 1 LEVEL)

No libraries beyond **NumPy**
No scikit-learn (introduced later)

✅ Example 1: Linear Regression Prediction

python

```python
# Hypothesis function
def predict(x, theta0, theta1):
    return theta0 + theta1 * x
```

```python
# Given values
theta0 = 100
theta1 = 200
x = 1.5

y_pred = predict(x, theta0, theta1)
print("Predicted value:", y_pred)
```

Output

yaml

```yaml
Predicted value: 400.0
```

Copy code

✅ Example 2: Cost Function (MSE)

python

```python
import numpy as np

# Data
x = np.array([1, 2])
y = np.array([300, 500])

theta0 = 100
theta1 = 200
m = len(x)

# Predictions
h = theta0 + theta1 * x

# Cost function
J = (1 / (2 * m)) * np.sum((h - y) ** 2)
print("Cost:", J)
```

✅ Example 3: One Iteration of Gradient Descent

python

```python
# Single data point
x = 1
y = 2

theta0 = 0
theta1 = 0
alpha = 0.1

# Prediction
h = theta0 + theta1 * x

# Gradient descent update
theta1 = theta1 - alpha * (h - y) * x

print("Updated theta1:", theta1)
```

📊 PART 3: EXAM QUESTIONS & ANSWERS (WEEK 1)

🔷 Very Short Answer (1–2 marks)

Q1. Define Machine Learning.   ⧉ Copy code

Answer:

Machine Learning is the field of study that enables computers to learn from data without being explicitly programmed.

Q2. What is supervised learning?

Answer:

Supervised learning uses labeled data to learn a mapping from inputs to outputs.

Q3. What is regression?

Answer:

Regression is a supervised learning task used to predict continuous values.

◆ Short Answer (3–5 marks)

Q4. Differentiate between regression and classification.

Answer:

Regression	Classification
Predicts continuous values	Predicts discrete labels
Example: house prices	Example: spam detection

Q5. What is a hypothesis in machine learning?

Answer:

A hypothesis is a function that maps input features to predicted outputs and represents the model.

◆ Long Answer (8–10 marks)

Q6. Explain the cost function used in linear regression.

Answer:

The cost function measures how well a model fits training data. In linear regression, Mean Squared Error is used:

$$J(\theta) = \frac{1}{2m} \sum (h_\theta(x) - y)^2$$

It penalizes large errors and helps guide optimization.

Q7. Explain gradient descent with formula.

Answer:

Gradient descent is an iterative optimization algorithm used to minimize the cost function by updating parameters in the direction of steepest descent.

$$\theta_j := \theta_j - \alpha \frac{\partial J}{\partial \theta_j}$$

Where α is the learning rate.

◆ MCQs (Common in Coursera)

Q8. Which learning rate causes divergence?

A. Very small

B. Moderate

C. Very large ✅

D. Zero

Q9. What does m denote?

A. Number of features

B. Number of parameters

C. Number of training examples ✅

D. Learning rate

✅ WEEK 1 COMPLETE ✔️

You now have:

- ✔️ Numerical problems
- ✔️ Python code
- ✔️ Exam Q&A

If you want next:

➡️ **Week 2 notes**

➡️ **PDF notes**

➡️ **Interview-focused questions**

➡️ **Handwritten-style diagrams**

Just tell me 👍

Try a short quiz ›

Test your knowledge on this topic