NumPy Temperature Trend Analysis Assignment (10 Points)

Objective: Apply NumPy and Python skills to analyze and visualize monthly temperature data, using arrays, functions, broadcasting, and plotting.

Scenario: You are analyzing daily high temperatures (in Celsius) for a city over 30 days: $[25, 26, 24, 23, 22, 21, 20, 19, 20, 22, 24, 25, 27, 28, 29, 30, 29, 28, 27, 26, 25, 24, 23, 22, 21, 20, 22, 24, 26, 28]$. Create a Jupyter notebook (`yourname_temp_trend.ipynb`) to process and visualize this data.

Tasks

1. **Array Setup and Attributes (3 points)**
   Create a NumPy array `temps` (dtype=float32) from the data. Print its `ndim`, `shape`, `size`, and `dtype`. Reshape into a 5x6 array (5 weeks, 6 days).
   Explanation: Briefly explain why `float32` is suitable (1 sentence, in a markdown cell).

2. **Statistics with Function (3 points)**
   Write a function `temp_stats(arr)` returning a tuple of (mean, standard deviation, min, max) using `np.mean`, `np.std`, `np.min`, `np.max`. Apply to `temps` and print results (e.g., "Mean: X.XX°C").
   Explanation: Explain why functions are useful here (1 sentence).

3. **Normalization and Broadcasting (2 points)**
   Write a function `normalize_temps(arr, scale=1.0)` to normalize `temps` by subtracting the mean and multiplying by `scale`. Apply with default `scale`. Print results. Compute differences from weekly means for the 5x6 array using broadcasting.
   Explanation: Explain how broadcasting simplifies weekly mean subtraction (1 sentence).

4. **Plotting (2 points)**
   Create `days = np.arange(1, 31)`. Plot `temps` (solid blue line, circle markers) and normalized `temps` (dashed red line). Add labels ("Day", "Temperature (°C)"), title ("Monthly Temperature Trends"), grid, and legend.
   Explanation: Explain how the plot aids analysis (1 sentence).

Instructions

- Use Python 3, `numpy` as `np`, `matplotlib.pyplot` as `plt`.
- Submit a Jupyter notebook (`yourname_temp_trend.ipynb`) with code in separate cells, markdown explanations, and comments.
- Ensure code runs without errors (test with "Restart & Run All").
- *Bonus (1 point):* Plot temperature differences from weekly means and explain insights.