

```

1 import pandas as pd
2 import numpy as np
3
4 # Define a function for quality control
5 def quality_control(df, spec_ranges):
6     """
7     Perform quality control by checking if product attributes fall within specified ranges.
8
9     :param df: DataFrame containing product attributes
10    :param spec_ranges: Dictionary with attribute names as keys and tuples with (min_value, max_value) as values
11    :return: DataFrame with a quality status (Pass/Fail) for each product
12    """
13    quality_status = []
14
15    for _, row in df.iterrows():
16        status = 'Pass'
17        for attribute, (min_val, max_val) in spec_ranges.items():
18            if not (min_val <= row[attribute] <= max_val):
19                status = 'Fail'
20                break
21        quality_status.append(status)
22
23    df['Quality_Status'] = quality_status
24    return df
25
26 # Sample data: Product ID, Weight, Size
27 data = {
28     'Product ID': ['P001', 'P002', 'P003', 'P004', 'P005'],

```

```
data = {
    'Product_ID': ['P001', 'P002', 'P003', 'P004', 'P005'],
    'Weight': [12.5, 15.3, 11.2, 14.0, 16.1], # in kilograms
    'Size': [20, 22, 19, 21, 23], # in centimeters
}

# Convert to DataFrame
df = pd.DataFrame(data)

# Define quality control specifications
specifications = {
    'Weight': (12.0, 15.0), # Weight should be between 12.0 and 15.0 kg
    'Size': (20, 22), # Size should be between 20 and 22 cm
}

# Apply quality control
df_quality = quality_control(df, specifications)

# Output the result
print(df_quality)
```