Payroll Anomaly Detection – Code & Output

Python Code:

```python
import pandas as pd
import numpy as np

# ========================
# 1. CREATE PAYROLL DATA
# ========================
data = {
    "employee_id": range(1, 21),
    "salary": [
        45000, 47000, 48000, 50000, 52000,
        51000, 49500, 50500, 49000, 51500,
        150000, 160000, 47000, 48000, 49000,
        50000, 52000, 300000, 51000, 48000
    ],
    "overtime_hours": [
        8, 9, 10, 7, 8,
        9, 10, 8, 9, 7,
        60, 55, 8, 9, 10,
        7, 8, 70, 9, 8
    ]
}

df = pd.DataFrame(data)

# ========================
# 2. Z-SCORE FUNCTION
# ========================
def z_score(series):
    mean = series.mean()
    std = series.std()
    return (series - mean) / std

# ========================
# 3. ANOMALY DETECTION
# ========================
df["salary_z"] = z_score(df["salary"])
df["overtime_z"] = z_score(df["overtime_hours"])

threshold = 3

df["salary_anomaly"] = df["salary_z"].abs() > threshold
df["overtime_anomaly"] = df["overtime_z"].abs() > threshold
df["final_anomaly"] = df["salary_anomaly"] | df["overtime_anomaly"]

print(df)
```

Program Output (Detected Anomalies)

employee_id	salary	overtime_hours	salary_z	overtime_z	salary_anomaly	overtime_anomaly	final_anomaly
1	45000	8	-0.44	-0.43	False	False	False
2	47000	9	-0.41	-0.38	False	False	False
3	48000	10	-0.39	-0.33	False	False	False
4	50000	7	-0.36	-0.48	False	False	False
5	52000	8	-0.33	-0.43	False	False	False
6	51000	9	-0.34	-0.38	False	False	False
7	49500	10	-0.37	-0.33	False	False	False
8	50500	8	-0.35	-0.43	False	False	False
9	49000	9	-0.37	-0.38	False	False	False
10	51500	7	-0.33	-0.48	False	False	False
11	150000	60	1.24	2.21	False	False	False
12	160000	55	1.4	1.96	False	False	False
13	47000	8	-0.41	-0.43	False	False	False
14	48000	9	-0.39	-0.38	False	False	False
15	49000	10	-0.37	-0.33	False	False	False
16	50000	7	-0.36	-0.48	False	False	False
17	52000	8	-0.33	-0.43	False	False	False
18	300000	70	3.63	2.72	True	False	True
19	51000	9	-0.34	-0.38	False	False	False
20	48000	8	-0.39	-0.43	False	False	False