```
import pandas as pd
import numpy as np
import re

# Step 1: Load the Data

from google.colab import drive
drive.mount('/content/drive')
file_path = '/content/drive/MyDrive/Data/messy_data1.csv'  # Replace 'MyDrive/Data' with your
actual folder path
df = pd.read_csv(file_path)

# Display initial data overview
print("Initial Data Overview:")
display(df.head())
display(df.info())


# Step 2: Inspect the Data

print(df.head())
print(df.info())

# Step 3: Record QA Issues (Export QA Issues to Excel)
qa_issues = []

def log_issue(field, issue, issue_type, line_number, solution, suggestion):
    qa_issues.append({
        "Field": field,
        "QA Issue": issue,
        "Issue Type": issue_type,
        "Data Line Number": line_number,
        "Solution": solution,
        "Suggestion": suggestion
    })

# Step 4: Handle Missing Values
df.dropna(subset=["ID", "Name", "Email", "Join Date"], inplace=True)  # Drop critical missing data
df["Age"].fillna(df["Age"].median(), inplace=True)
df["Salary"].fillna(df["Salary"].mean(), inplace=True)
df["Department"].fillna("Unknown", inplace=True)

# Step 5: Remove Duplicates
df.drop_duplicates(subset=["ID"], keep="first", inplace=True)

# Step 6: Correct Email Formats
def validate_email(email):
    pattern = r'^[a-zA-Z0-9_.+-]+@[a-zA-Z0-9-]+\.[a-zA-Z0-9-.]+$'
    return bool(re.match(pattern, str(email)))

df = df[df["Email"].apply(validate_email)]
```

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def is_professional_email(email):
    return not any(domain in email for domain in ["gmail.com", "yahoo.com", "hotmail.com"])

df = df[df["Email"].apply(is_professional_email)]

# Step 7: Clean Name Fields
df["Name"] = df["Name"].str.strip().str.title()

# Step 8: Standardize Date Formats
df["Join Date"] = pd.to_datetime(df["Join Date"], errors='coerce')

df.dropna(subset=["Join Date"], inplace=True)  # Remove rows where date conversion failed

# Step 9: Correct Department Names
Department_mapping = {
    "Hr": "HR", "Human Resources": "HR",
    "Eng": "Engineering", "Engg": "Engineering", "Engineer": "Engineering",
    "Mkt": "Marketing", "Mkting": "Marketing",
    "Sal": "Sales", "Sls": "Sales",
    "Supp": "Support", "Cust Support": "Support"
}
df["Department"] = df["Department"].replace(Department_mapping)
#df["department"] = df["department"].replace(Department_mapping)
df["Department"] = df["Department"].str.replace(r'^Sal.*$', 'Sales', regex=True)
df["Department"] = df["Department"].str.replace(r'^HR.*$', 'Human Resource', regex=True)
df["Department"] = df["Department"].str.replace(r'^Eng.*$', 'Engineering', regex=True)
df["Department"] = df["Department"].str.replace(r'^Mark.*$', 'Marketing', regex=True)
df["Department"] = df["Department"].str.replace(r'^Sup.*$', 'Support', regex=True)


# Step 10: Handle Salary Noise
q99 = df["Salary"].quantile(0.99)
df["Salary"] = df["Salary"].clip(upper=q99)

# Export QA Issues to Excel
qa_df = pd.DataFrame(qa_issues)
qa_df.to_excel("QA_Issues_Report.xlsx", index=False)

# Save the Cleaned Data
df.to_csv("cleaned_data.csv", index=False)

print("\nData Cleaning Completed!")
```