Task-1

```
import numpy as np
import matplotlib.pyplot as plt
print("\n" + "="*50)
print("TASK 1: BORN RULE - MEASUREMENT PROBABILITIES")
print("="*50)
def born_rule_probabilities(psi):
    """Calculate measurement probabilities using Born rule: P = |<basis|psi>|^2"""
    probabilities = np.abs(psi)**2
    return probabilities / np.sum(probabilities) # Normalize
psi_1 = np.array([1/np.sqrt(2), 1/np.sqrt(2)]) # |+⟩ state
psi_2 = np.array([1/np.sqrt(3), np.sqrt(2/3)]) # Custom superposition
print("Superposition state 1: |ψ₁⟩ =", psi_1)
print("Measurement probabilities:", born_rule_probabilities(psi_1))
print("Superposition state 2: |ψ₂⟩ =", psi_2)
print("Measurement probabilities:", born_rule_probabilities(psi_2))
states = ['|0⟩', '|1⟩']
probs_1 = born_rule_probabilities(psi_1)
probs_2 = born_rule_probabilities(psi_2)
plt.figure(figsize=(10, 4))
plt.subplot(1, 2, 1)
plt.bar(states, probs_1, color='blue', alpha=0.7)
plt.title('State |ψ₁⟩ Probabilities')
plt.ylabel('Probability')
plt.subplot(1, 2, 2)
```

```
plt.bar(states, probs_2, color='red', alpha=0.7)
plt.title('State |ψ₂⟩ Probabilities')
plt.ylabel('Probability')
```