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Q-1 $X \leq 15$

$P(X \leq 15) = \frac{15-10}{20-10} = 0.5$

Q-2 $P(12 \leq X \leq 18) = \frac{18-12}{20-10} = 0.6$

Q-3 Mean $= (10+20)/2 = 15$

Variance $= (20-10)^2/12 = \frac{100}{12} = 8.33$

Q-2 Mean $= 10$, Standard Deviation $= 10$

1) $P(X>80) = 1-\phi\left(\frac{80-70}{10}\right) = 1-\phi(1) = 0.1$

2) $P(60 \leq X 75) = \phi\left(\frac{75-70}{10}\right) - \phi\left(\frac{60-70}{10}\right) = \phi(0.5) - \phi(-1)$

$= 0.6915 - 0.1587$

$= 0.53$

Q-3 Mean $= 1$ kg

Standard deviation $= 0.05$ kg

1. $P(0.95 \leq x \leq 1.05) = \phi\left(\frac{1.05-1}{0.05}\right) = \phi 1 - \phi(-1)$

$= 0.6827$

2. $P(X < 0.9) = \phi\left(\frac{0.9-1}{0.05}\right) = \phi(-2) = 0.022$

3. $P(X > 1.1) = 1 - \phi\left(\frac{1.1-1}{0.05}\right) = 1-\phi(2)$

$= 0.0228$

Q-4 0 - 30

1. $P(Y > 10) = \frac{30 - 10}{30 - 0} = \frac{20}{30} = 0.66$

2. $P(5 \leq Y \leq 25) = \frac{25 - 5}{30} = \frac{20}{30} = 0.66$

3. Mean $= \frac{0 + 30}{2} = 5$

4. Variable $= \frac{(30 - 0)}{12} = 75$

Q-5

1. $P(X > 170) = 1 - \phi\left(\frac{170 - 160}{8}\right) = 1 - \phi(1.25)$
$= 0.1056$

2. $P(150 \leq X \leq 165) = \phi\frac{(165 - 160)}{8} = \phi\frac{(150 - 160)}{8}$
$= \phi(0.625) - \phi(-1.25)$
$= 0.6284$

3. Expected <155 from 100 => $100 \times \phi\frac{(155 - 160)}{8}$
$= 100 - \phi(-0.625)$
$= 26.6$

Q-6 1. $P(-2 \leq Z \leq 2) = \frac{2 - (-2)}{5 - (-5)} = \frac{4}{10} = 0.4$

2. $P(Z < -3) \frac{(-3(-5))}{10} = \frac{2}{10} = 0.2$

3. Mean $= \frac{(-5 + 5)}{2} = 0$

Variance $= \frac{(5 - (-5))^2}{12} = 8.33$

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7. $N(500, 50)$

1. $P(D > 600) = 1 - \phi \dfrac{(600-500)}{50} = 0.022$

2. $P(450 \le D \le 500) = \phi(1) - \phi(-1) = 0.6827$

3. $D > 520$ from $1000 \Rightarrow 1000 \times \phi \dfrac{(520-500)}{50}$

$= 0.344$

8. 1. $P(W \geq 60) = \dfrac{70-60}{70-50} = \dfrac{10}{20} = 0.5$

2. $P(55 \le W \le 65) = \dfrac{65-55}{20} = 0.5$

3. Mean $= \dfrac{50+70}{2} = 60$

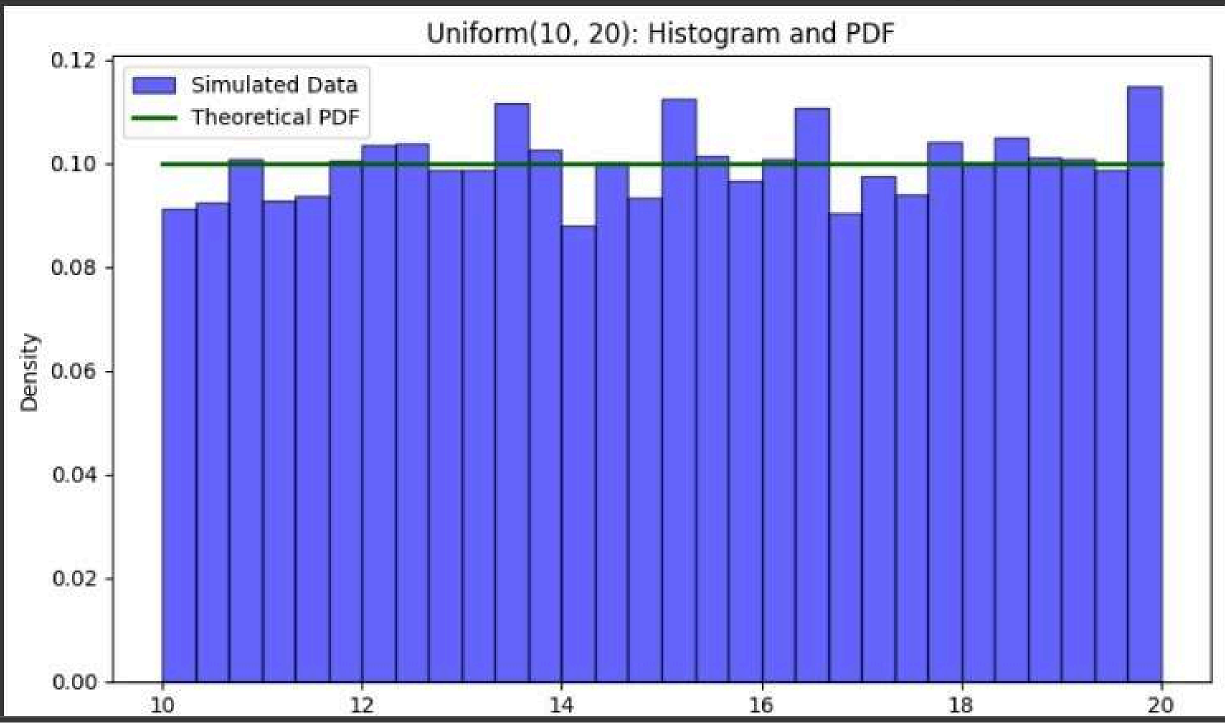
Variance $= \dfrac{(70-50)^2}{12} = 400/12 = 13.3$

Q-9 All outcome are equally likely

Q-10 a) $\dfrac{(b-a)^2}{12}$

```
import numpy as np
import matplotlib.pyplot as plt
from scipy.stats import uniform
samples_uniform = np.random.uniform(10, 20, 10000)
x_uniform = np.linspace(10, 20, 500)
pdf_uniform = uniform.pdf(x_uniform, 10, 10)

plt.figure(figsize=(8,5))
plt.hist(samples_uniform, bins=30, density=True, alpha=0.6, color='blue', edgecolor='black', label='Simulated Data')
plt.plot(x_uniform, pdf_uniform, lw=2, color='darkgreen', label='Theoretical PDF')
plt.xlabel('Value')
plt.ylabel('Density')
plt.title('Uniform(10, 20): Histogram and PDF')
plt.legend()
plt.tight_layout()
plt.show()
```

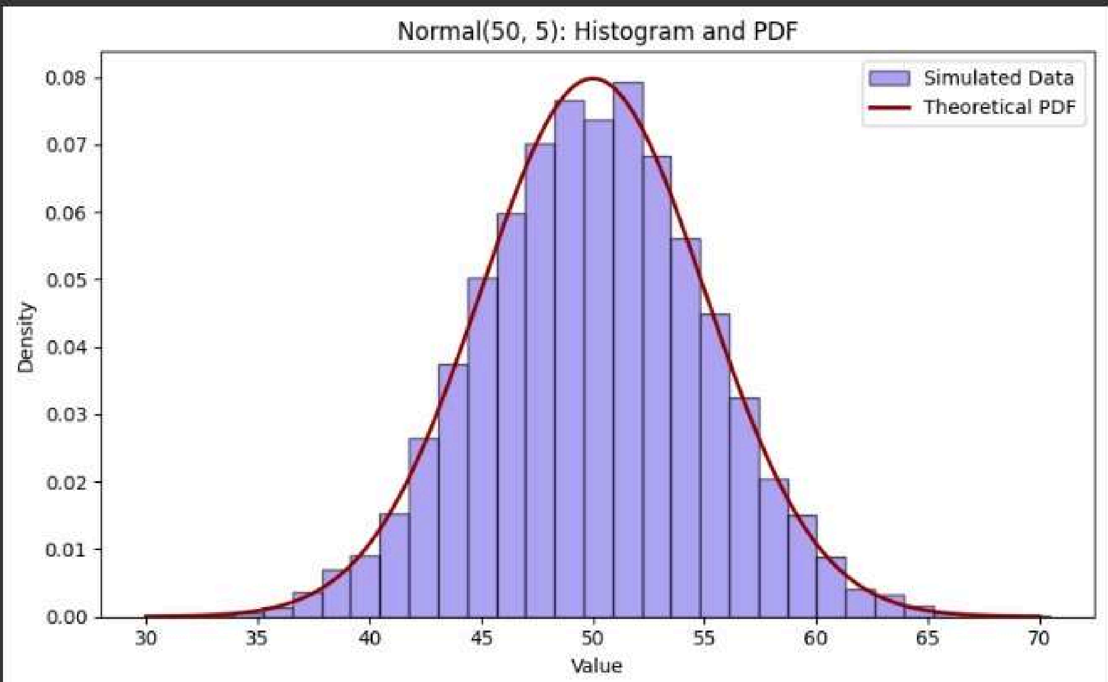


```python
import numpy as np
import matplotlib.pyplot as plt
from scipy.stats import norm

samples_normal = np.random.normal(50, 5, 10000)
x_normal = np.linspace(30, 70, 500)
pdf_normal = norm.pdf(x_normal, 50, 5)

plt.figure(figsize=(8,5))
plt.hist(samples_normal, bins=30, density=True, alpha=0.6, color='mediumslateblue', edgecolor='black', label='Simulated Data')
plt.plot(x_normal, pdf_normal, lw=2, color='darkred', label='Theoretical PDF')
plt.xlabel('Value')
plt.ylabel('Density')
plt.title('Normal(50, 5): Histogram and PDF')
plt.legend()
plt.tight_layout()
plt.show()

perc_45_55 = np.mean((samples_normal >= 45) & (samples_normal <= 55)) * 100
print(f"Percentage of values between 45 and 55: {perc_45_55:.2f}%")
```



```python
import numpy as np
import matplotlib.pyplot as plt
from scipy.stats import norm

marks = np.random.normal(70, 10, 500)
above_80 = np.sum(marks > 80)
between_60_75 = np.sum((marks >= 60) & (marks <= 75))
below_50 = np.sum(marks < 50)
print(f"Scored above 80: {above_80}")
print(f"Between 60 and 75: {between_60_75}")
print(f"Below 50: {below_50}")

plt.figure(figsize=(8,5))
plt.hist(marks, bins=25, color='teal', edgecolor='black', alpha=0.7)
plt.xlabel('Marks')
plt.ylabel('Frequency')
plt.title('Histogram of Marks (N(70, 10))')
plt.tight_layout()
plt.show()

plt.figure(figsize=(8,5))
plt.hist(marks, bins=25, density=True, cumulative=True, color='goldenrod', edgecolor='black', alpha=0.7, label='Empirical CDF')
x_marks = np.linspace(min(marks), max(marks), 500)
cdf_marks = norm.cdf(x_marks, 70, 10)
plt.plot(x_marks, cdf_marks, lw=2, color='navy', label='Theoretical CDF')
plt.xlabel('Marks')
plt.ylabel('Cumulative Probability')
plt.title('Cumulative Distribution of Marks')
plt.legend()
plt.tight_layout()
plt.show()
```

```
Scored above 80: 79
Between 60 and 75: 258
Below 50: 11
```