CT-1 Solutions

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UNIT 1

1. Purpose of Cash Flow Discounting

Answer: B. To convert future cash flows into present value

2. Asset Pricing Model Assuming Efficient Market Portfolio

Answer: B. Capital Asset Pricing Model (CAPM)

3. Integration of Financial Analysis and Machine Learning

Traditional financial analysis employs risk-return analysis, cash flow discounting, and asset pricing models to make investment decisions.

- **Risk-return analysis** evaluates expected returns relative to risk (volatility).
- **Cash flow discounting** brings future inflows to present value using discount rates.
- **Asset pricing models** (CAPM, APT) estimate required returns for taking on specific risk.

Emerging machine learning (ML) techniques enhance these by:

- Using predictive models to forecast returns, risk, and potential anomalies more accurately.
- Applying data-driven insights to identify hidden patterns in large datasets.
- Automating decision-making processes for dynamic portfolio management.

4. NPV Calculation

```
CF1 = 800
CF2 = 1000
CF3 = 1200
r = 9% = 0.09

NPV = CF1 / (1 + r)^1 + CF2 / (1 + r)^2 + CF3 / (1 + r)^3
```

NPV: $2502.25

5. Mean, Variance, Standard Deviation, and Beta

```
Returns = [7, 10, 4, 8, 12]
Mean = sum / n
Variance = sum((xi - mean)^2) / (n - 1)
Std Dev = sqrt(variance)

Beta = Cov(stock, market) / Var(market)
```

Mean Return: 8.20%

Variance: 9.2000

Standard Deviation: 3.0332

Beta: 0.9000

UNIT 2

1. Order-Driven Market Matching Mechanism

Answer: B. Limit order book

2. Interest Rate Compounding

Answer: B. Reflect the time value of money

3. Portfolio Risk in Mean-Variance Framework

Answer: B. Asset correlations and individual variances

4. Efficient Frontier Representation

Answer: B. The set of portfolios that offer the maximum expected return for a given level of risk

5. Portfolio Optimization Principles

- **Efficient frontier:** Set of optimal portfolios offering maximum return for a given risk.
- **Minimum variance portfolio:** Portfolio with the lowest risk for a given return.
- **Risk-free lending/borrowing:** Shifts the efficient frontier to the capital market line (CML), improving risk-return trade-off.

6. Two-Asset Portfolio Expected Return and Standard Deviation

```
E(Rp) = wA * RA + wB * RB
σp = sqrt( wA^2 * σA^2 + wB^2 * σB^2 + 2 * wA * wB * ρAB * σA * σB )

Given:
wA = 0.5, wB = 0.5
RA = 9%, RB = 13%
σA = 10%, σB = 18%
ρAB = 0.5
```

Expected Return: 11.00%

Standard Deviation: 12.29%

7. Minimum Variance Portfolio (Three Assets)

```
Given Expected Returns: [8%, 11%, 14%]
Covariance Matrix:
[0.025  0.010  0.005]
[0.010  0.040  0.015]
[0.005  0.015  0.090]
```

This problem requires solving:
Minimize `w'Σw`
Subject to: `w1 + w2 + w3 = 1`

Solution requires linear algebra (matrix inversion or quadratic programming).
This is a complex calculation; implementation can be done in Python or MATLAB for exact weights.

```
Minimum Variance Portfolio (MVP) for Three Assets
----------------------------------------------------------
Expected Returns (given, not directly used in MVP calc):
Asset 1: 8.00%
Asset 2: 11.00%
Asset 3: 14.00%

Covariance Matrix:
[[0.025 0.01 0.005]
 [0.01 0.04 0.015]
 [0.005 0.015 0.09 ]]

Inverse of Covariance Matrix (Σ⁻¹):
[[ 44.4811 -10.8731 -0.659 ]
 [-10.8731 29.3245 -4.2834]
 [ -0.659  -4.2834 11.8616]]

Vector of Ones: [1. 1. 1.]

--- Results ---
Weight of Asset 1: 0.6098 (60.98%)
Weight of Asset 2: 0.2622 (26.22%)
Weight of Asset 3: 0.1280 (12.80%)

Minimum Portfolio Variance: 0.018506
Minimum Portfolio Standard Deviation (Risk): 0.1360

--- End of Calculation ---
```