Session 07-08 - Mock Exam 2

Section 07: Probability & Statistics

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Mock Exam 2 - Overview

Today's Session Structure

- Part 1: Review of key formulas (15 minutes)
- Part 2: Mock Exam (120 minutes)
- Part 3: Break (15 minutes)
- Part 4: Solution discussion (30 minutes)

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> ! Important
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> This exam covers all material from Sections 01-07, with emphasis on probability!

Formula Review

Probability Formulas

Concept	Formula
Complement	$P(A') = 1 - P(A)$
Addition	$P(A \cup B) = P(A) + P(B) - P(A \cap B)$
Conditional	$P(A \parallel B) = \frac{P(A \cap B)}{P(B)}$
Multiplication	$P(A \cap B) = P(A \parallel B) \cdot P(B)$
Independence	$P(A \cap B) = P(A) \cdot P(B)$
Bayes	$P(A \parallel B) = \frac{P(B \parallel A) \cdot P(A)}{P(B)}$

Counting and Distributions

Concept	Formula
Permutation	$P(n, r) = \frac{n!}{(n-r)!}$
Combination	$C(n, r) = \binom{n}{r} = \frac{n!}{r!(n-r)!}$
Binomial	$P(X = k) = \binom{n}{k} p^k (1-p)^{n-k}$

Concept	Formula
Binomial mean	$\mu = np$
Binomial std	$\sigma = \sqrt{np(1-p)}$
Geometric	$P(X = n) = (1-p)^{n-1}p$

Medical Testing

Metric	Definition
Sensitivity	$P(+ \parallel D)$
Specificity	$P(- \parallel D')$
False positive rate	$P(+ \parallel D') = 1 - \text{Specificity}$
False negative rate	$P(- \parallel D) = 1 - \text{Sensitivity}$
PPV	$P(D \parallel +)$
NPV	$P(D' \parallel -)$

Calculus Review

Concept	Formula
Power rule (diff)	$(x^n)' = nx^{n-1}$
Power rule (int)	$\int x^n dx = \frac{x^{n+1}}{n+1} + C$
Integration by parts	$\int u\,dv = uv - \int v\,du$
Definite integral	$\int_a^b f(x)dx = F(b) - F(a)$
Area between curves	$\int_a^b [f(x) - g(x)]dx$

Mock Exam Instructions

Exam Rules

- Duration: 120 minutes
- Materials allowed: Calculator, formula sheet
- Show all work: Partial credit is awarded
- Answer ALL questions
- Box your final answers

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> ⚠ Warning
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> No communication with other students during the exam!

Grading Breakdown

Problem	Topic	Points
Problem 1	Functions and Calculus	30
Problem 2	Integration and Applications	30
Problem 3	Probability and Statistics	40
Total		100

Begin Mock Exam

Problem 1: Functions and Calculus (30 points)

See exam handout for full problem.

Topics covered: - Function analysis (domain, zeros, extrema) - Derivative calculations - Curve sketching - Tangent line equations

Problem 2: Integration (30 points)

See exam handout for full problem.

Topics covered: - Indefinite integrals - Integration by parts - Definite integrals - Area between curves - Business applications

Problem 3: Probability (40 points)

See exam handout for full problem.

Topics covered: - Contingency tables - Conditional probability - Bayes' theorem - Binomial distribution - Medical testing (sensitivity, specificity, PPV)

Break - 15 Minutes

Solution Discussion

Problem 1 Solutions

Key Points

- Always check domain first
- Use first and second derivative tests systematically
- Verify extrema and inflection points
- Tangent line: $y - f(a) = f'(a)(x - a)$

Problem 2 Solutions

Integration by Parts Reminder

For $\int xe^x dx$: - Choose $u = x$ (algebraic), $dv = e^x dx$ - Result: $e^x(x-1) + C$

For $\int x^2 e^{-x} dx$: - Apply twice - Result: $-e^{-x}(x^2 + 2x + 2) + C$

Problem 3 Solutions

Contingency Table Strategy

1. Draw the table first
2. Fill in given values
3. Use row/column sums to find unknowns
4. Calculate probabilities directly from table

Bayes' Theorem Strategy

$$P(D \mid +) = \frac{P(+ \mid D) \cdot P(D)}{P(+ \mid D) \cdot P(D) + P(+ \mid D') \cdot P(D')}$$

Or use the contingency table method with a hypothetical population!

Self-Assessment

Evaluate Your Performance

Score yourself honestly:

Score Range	Assessment
85-100	Excellent - well prepared
70-84	Good - minor review needed
55-69	Satisfactory - focused review needed
Below 55	Needs work - comprehensive review

Areas for Review

Based on your performance, prioritize:

- Integration by parts (if missed Problem 2c)
- Contingency tables (if missed Problem 3a)
- Bayes' theorem (if missed Problem 3b)
- Binomial distribution (if missed Problem 3c)

Preparation for Final Exam

Remaining Sessions

- Section 08: Financial Mathematics (2 sessions)
- Section 09: Synthesis & Final Preparation (5 sessions)
- Section 10: Final Confidence Session

Key Recommendations

! Study Strategy

1. Review all mock exams and understand every solution
2. Practice integration by parts until automatic
3. Create a comprehensive formula sheet
4. Time yourself on practice problems
5. Focus on your weakest areas

Homework Assignment

Before Next Session

1. Review all solutions from today's mock exam
2. Redo any problems you didn't solve correctly
3. Create a study plan for remaining weaknesses
4. Complete any unfinished tasks from Section 07

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Tip

The probability section is now complete. Make sure you're confident with all material before the final exam!