

THE UNIVERSITY OF WESTERN ONTARIO
DEPARTMENT OF STATISTICAL AND ACTUARIAL SCIENCES
Actuarial Science 223a
MIDTERM EXAMINATION

Tuesday, October 29, 1996, SSC Room 3026 Time: 7:00 P.M. - 9:00 P.M.
2 hours

INSTRUCTIONS

- RECORD NAME AND STUDENT NUMBER ON THE ANSWER SHEET, QUESTION PAPER AND EXAMINATION BOOKLET.
- Do all your work on the exam paper.
- Non-programmable calculators only are permitted.
- There is a total of 50 possible marks.
 1. 30 marks for multiple choice
 2. 20 marks for short answer
- Do all rough work on paper/books provided and hand in all your work

Part A: Multiple Choice Questions

There are 15 multiple choice questions. EACH correct answer is worth two marks. Read the questions carefully. Record answers on separate answer sheet attached. No extra time will be provided for filling in the answer sheet.

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1. What is the accumulated value, on March 27, 1995 assuming exact simple interest at 8%, of \$2,000 deposited on January 1, 1995?

A) \$2,036.89	B) \$2,037.78	C) \$2,037.15	D) \$2,037.99
E) \$2,037.26			

2. Same question as 1 but assume the bankers rule.

A) \$2,036.89	B) \$2,037.78	C) \$2,036.15	D) \$2,037.99
E) \$2,037.26			

3. What is the amount of interest earned on \$20,000 invested for 2 years, if the rate of simple interest is 8% every 6 months?

A) \$3,200	B) \$4,400	C) \$6,000	D) \$6,400
E) \$6,800			

4. How much more would have to be invested at time 0 in order to accumulate \$1,000 at the end of 3 years, at a simple interest rate of 9% versus a compound interest at 9%?

A) \$15.22	B) \$15.29	C) \$15.47	D) \$15.97
E) \$16.02			

5. Which of the following is false:

(I) $(1+i)^{-1} = v$	(II) $d = \frac{i}{1+i}$	(III) $i-d = \frac{i^2}{1+i}$	(IV) $d = 1-v$
A) I	B) II	C) III	D) IV
			E) V

6. Assuming a rate of simple interest of 10%, find d_5 :

A) $\frac{1}{2}$	B) $\frac{1}{5}$	C) $\frac{1}{6}$	D) $\frac{1}{8}$
			E) $\frac{1}{15}$

7. On July 1, 1994, \$1,000 was invested in a fund for which the force of interest at time t is given by $\delta_t = \frac{3+2t}{50}$, where t is the number of years since January 1, 1994. Determine the accumulated value of the investment on January 1, 1995.

A) \$1,036	B) \$1,041	C) \$1,045	D) \$1,046
E) \$1,051			

8. Which of the following is equal to $\left(\frac{d}{dv}d\right)\left(\frac{d}{dt}d\right)$?

A) $-v^3$	B) $-v$	C) 1	D) v
			E) v^3

9. Find the force of interest equivalent to a discount rate of 4% convertible semi-annually.
 A) $\frac{1}{2} \log_e .98$ B) $\log_e (.98)^2 - 1$ C) $-2 \log_e .98$ D) $2 \log_e .98$ E) $\log_e (.98)^{-2} - 1$
10. A \$10,000 loan is to be repaid by monthly \$1,000 payments, the first payment due in 1 years time. If $i^{12} = 12\%$, find the amount of the final payment if the last payment is larger than the rest (1% interest tables are attached).
 A) \$888 B) \$1,080 C) \$1,112 D) \$1,500 E) \$1,880
11. If $a_{\overline{n}|} = 2$ and $s_{\overline{2n}|} = 12$, find i (assume n and i are > 0).
 A) 10% B) 15% C) 20% D) 25% E) Either 25% or $66\frac{2}{3}\%$
12. How many years will it take for \$750 to double if interest is at 6%?
 A) 12 B) 11 C) 10 D) 9 E) 8.7
13. \$1,000 is deposited into a fund now and \$X at the end of 2.5 years is deposited into the same fund in order to accumulate a total fund amount of \$2X at the end of 5 years. Find \$X if $i^2 = 8\%$.
 A) \$4,068.29 B) \$1,889.63 C) \$1,865.01 D) \$1,356.38 E) \$1,000
14. Payments of \$300, \$500, and \$700 are made at the end of years five, six and eight respectively. Interest is accumulated at an annual rate of 4%. Calculate \bar{i} , the point at which a single payment of \$1,500 is equivalent to the payment series above, using the method of equated time.
 A) 6.65 B) 6.70 C) 6.73 D) 6.79 E) 6.81
15. If $A(t) = 100t^2 + 200t + 100$, find the present value of 4 payments of \$100 (1st payment made 1 year from now).
 A) \$43.40 B) \$44.60 C) \$45.47 D) \$46.36 E) \$47.01

Part B: Essay Questions (total of 20 marks)

Do each of the following 4 problems. Part marks will be given where warranted.
Show all the work done in solving these problems.

1. (8 marks)

- (a) An individual makes 10 annual deposits of \$1,500, with the first deposit made now, in order to buy a perpetuity of \$X per year, starting at the end of the 10th year. The interest rate up to the end of the 11th year is 4%, and 5% thereafter. Find X.
- (b) Simplify $a_{\overline{15}|}(1 + v^{15} + v^{30})$ to one symbol.

2. (5 marks) You are given that $A(t) = Kt^2 + Lt + M$, for $0 \leq t \leq 2$, and that $A(0) = 100$, $A(1) = 110$, and $A(2) = 136$. Find the force of interest at $t = \frac{1}{2}$.

3. (4 marks) \$1,000 is deposited at the beginning of each year for 20 years. Simple interest at an annual rate of i is credited to each deposit from the date of deposit to the end of the twenty year period. The total amount accumulated at the end of 20 years is \$28,400. What would the accumulated value of the deposits have been if compound interest of i had been credited instead (of simple interest at i)?

4. (3 marks) The present value of a 10 year annuity due of annual payments of \$100 is \$803.36 and the present value of a 20 year annuity due with the same annual payment amount (and interest rate) is \$1,285.37. Find i .