

# Second Exam 101 in Finite Mathematics 131

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## Formulas

### Compound Interest:

$P$  := Principal = Present Value

$S$  := Compound Amount = Future Value

$r$  := nominal rate = annual rate

$r_e$  := effective rate

$n$  := number of periods per year

$t$  := number of years

$$S = P(1 + r_e)^t = \begin{cases} P(1 + \frac{r}{n})^{nt} & \text{if compounded } n \text{ times per year,} \\ Pe^{rt} & \text{if compounded continuously.} \end{cases}$$

$$1 + r_e = \begin{cases} (1 + \frac{r}{n})^n & \text{if compounded } n \text{ times per year,} \\ e^r & \text{if compounded continuously.} \end{cases}$$

### Annuities:

$R$  := payment per period

$A$  := Present Value

$S$  := Amount = Future Value

$r$  := rate per period

$n$  := number of periods

	Ordinary Annuity	Annuity Due
Present Value:	$A = R \frac{1 - (1 + r)^{-n}}{r}$	$A = R \left[ \frac{1 - (1 + r)^{1-n}}{r} + 1 \right]$
Future Value:	$S = R \frac{(1 + r)^n - 1}{r}$	$S = R \left[ \frac{(1 + r)^{n+1} - 1}{r} - 1 \right]$

### Counting/Probability:

$${}_n P_r = \frac{n!}{(n-r)!}$$

$${}_n C_r = \binom{n}{r} = \frac{n!}{(n-r)!r!}$$

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

## Written Part

**W1 (9 points)** The Smiths have \$ 50,000 to invest for 18 months. They have two options:

- A certificate paying interest at the nominal rate of 5 % compounded quarterly.
- A savings account earning interest at the annual rate of 4.5 % compounded continuously.

How much money would they have in 18 months in each of the two options? Find the difference between the earned interests of the both options.

**W2 (9 points)** Suppose that two openings on an appellate court bench are to be filled from current municipal court judges. The municipal court judges consist of 23 men and 4 women. If the two candidates are chosen randomly, find the probability that

- (A) both appointees are men.
- (B) one man and one woman are appointed.
- (C) at least one woman is appointed.

**W3 (10 points)** Two coins are tossed and a die is rolled. Find

- (A) an equiprobable sample space.
- (B) the probability that the number on the die is odd.
- (C) the probability that one coin shows head, one tail and the number on the die is odd.
- (D) the probability that at least one coin shows head or the die shows a four.
- (E) the probability that the number on the die is equal to the number of heads.

**W4 (9 points)** A debt of \$ 12000 due 9 years from now is instead to be paid of by 3 payments: \$ 2000 now, \$ 2000 in 4 years, and a final payment at the end of 7 years. What would this payment be if an interest rate of 6% compounded annually is assumed?

**W5 (9 points)** An artist has created 18 original paintings, and she will exhibit some of them in four galleries. Three paintings will be sent to gallery A, another three to gallery B, four to gallery C, and five to gallery D. In how many ways can this be done? Explain your solution!

**W6 (9 points)** For the sample space  $S = \{1, 2, 3, 4, 5\}$ , suppose that the sample points 1, 2, 3 have the same probability and that  $P(\{1, 4, 5\}) = 0.4$ . Determine  $P(1)$ .

## Multiple Choice Part

**M1 (5 points)** Suppose \$ 100 are deposited at the beginning of each month for 3 years in an account that pays 6 % compounded monthly. Find the future value of this annuity due.

- (A) \$ 3287.10
- (B) \$ 3303.54
- (C) \$ 3933.61
- (D) \$ 3953.28 ←
- (E) \$ 12626.81

**M2 (5 points)** Let  $E$  and  $F$  be events with complements  $E'$  and  $F'$ . If  $P(E')=0.6$ ,  $P(E \cup F)=0.7$  and  $P(E \cap F)=0.2$  then  $P(F')$  is equal to:

- (A) 0.3
- (B) 0.4
- (C) 0.5 ←
- (D) 0.6
- (E) 0.7

**M3 (5 points)** A pair of well-balanced dice is rolled, and the number on each die is noted. Determine the probability that the sum of these two numbers is bigger or equal to 10.

- (A) 0.0278
- (B) 0.0556
- (C) 0.1111
- (D) 0.1667 ←
- (E) 0.3333

**M4 (5 points)** A voice teacher selects nine students from his class to sing for the trustees. The class consists of 13 men and 9 women. In how many ways can 9 students be selected and arranged in a row with 5 men in the middle and 2 women on each end (**W W M M M M M W W**)?

- (A) 162,162
- (B) 42,352,480
- (C) 259,459,200
- (D) 467,026,560 ←
- (E) 800,616,960

**M5 (5 points)** Four fair coins are tossed. Determine the probability that exactly 2 heads occur.

(A)  $\frac{1}{16} = 0.0625$

(B)  $\frac{3}{16} = 0.1875$

(C)  $\frac{3}{8} = 0.375 \leftarrow$

(D)  $\frac{5}{8} = 0.625$

(E)  $\frac{3}{4} = 0.75$

**M6 (5 points)** A survey of 175 students resulted in the table below, which shows the type of college the student attends and the income level of the student's family. Find the probability that a randomly selected student attends a public college or comes from a low-income family.

(A)  $\frac{12}{35} = 0.343$

(B)  $\frac{2}{5} = 0.400$

(C)  $\frac{10}{21} = 0.476$

(D)  $\frac{136}{175} = 0.777 \leftarrow$

(E)  $\frac{25}{28} = 0.893$

Income\College	Private	Public	Total
High	14	11	25
Middle	25	55	80
Low	10	60	70
Total	49	126	175

**M7 (5 points)** Given an interest rate of 4% compounded annually, find the present value of an ordinary annuity of \$ 1000 due at the end of each year for four years and \$ 3000 due thereafter at the end of each year for another four years.

(A) \$8,962.43

(B) \$9,742.42

(C) \$10,341.86

(D) \$11,387.92

(E) \$12,938.44  $\leftarrow$

**M8 (5 points)** A company employs 65 people. Eight of the 30 men and 21 of the 35 women work in the business office. What is the probability that an employee picked at random is a woman or works in the business office?

(A)  $\frac{43}{65} = 0.662 \leftarrow$

(B)  $\frac{29}{65} = 0.446$

(C)  $\frac{56}{65} = 0.862$

(D)  $\frac{22}{65} = 0.338$

(E)  $\frac{64}{65} = 0.985$

**M9 (5 points)** What annual rate  $r$  compounded continuously is equivalent to an annual rate of 8% compounded quarterly?

(A) 7.834%

(B) 7.921%  $\leftarrow$

(C) 8.083%

(D) 7.750%

(E) 7.982%

**M10 (5 points)** A principal  $P$  doubled in 10 years. What was the annual rate if interest was compounded quarterly?

(A) 6.5%

(B) 7.0%  $\leftarrow$

(C) 7.5%

(D) 8.0%

(E) 8.5%

**M11 (5 points)** How many distinguishable permutations of the letters in the word **INTRINSIC** are possible?

(A) 362880

(B) 1088640

(C) 10080

(D) 120960

(E) 30240  $\leftarrow$