University of Bahrain
Bahrain Teachers College
TC2MA324: Hisotry of Mathematics
Dr. Abdulla Eid
Spring 2015

Mid Term Exam 2

Name: _____ ID:_____

Instructor's name: Dr. Abdulla Eid

- *Do not* open the exam until you are instructed to do so.

- Show sufficient work to justify each answer.

- Calculators are allowed but cell phones are *not* allowed during the exam.

- Exchange of any material such as calculator, pen, eraser is *not* allowed.

- **No** questions are allowed.

- You have 2 hours to finish this exam. You can leave only after 1 hour of the exam.

- There are 9 questions and 10 pages in this exam.

Question	Points	Score
1	10	
2	3	
3	6	
4	3	
5	3	
6	5	
7	5	
8	10	
9	5	
Total:	50	

Question 1   (10 points)

Choose the correct answer for each of the following (All currencies are in Bahraini Dinars):

(1) Find the simple interest. Assume a 360-day year. Round results to the nearest cent. 15,000 at 5% for 100 days

     (A) 208.33   (B) 206.25   (C) 15,208.33   (D) 750.00

(2) A local business deposited 240,000 in a 2-year time deposit earning 4% compounded daily. At maturity (future), what is the compound amount and interest earned?

     (A) 270,597.47; 30,597.47   (B) 265,239.20; 25,239.20   (C) 259,987.76; 19,987.76
     (D) 293,132.65; 53,132.65

(3) A loan of 24,000 at 12% compounded quarterly resulted in a maturity value (future) of 30,402.01. Find the term or length of the loan.

     (A) 4 years   (B) 1 year   (C) 2 years   (D) 8 years

(4) Find the interest rate paid if a deposit of 20,500 grows to 26,081.53 in 3.5 years, with interest compounded semiannually.

     (A) 3.5%   (B) 3%   (C) 6%   (D) 7%

(5) How long will it take for prices in the economy to double at a 5% annual inflation rate? Round answer to the nearest year.

     (A) 5 years   (B) 18 years   (C) 10 years   (D) 14 years

Question 2   (3 points)

Find each of the following:

1. $97 \mod 7$.

2. $101 \mod 7$.

3. $(97+101) \mod 7$.

4. $(97 \cdot 101) \mod 7$.

5. $(97)^{401} \mod 7$.

Question 3   (6 points)

Consider the following set of preference ballot lists of 9 voters:

	3	1	1	1	1	1	1
1st choice	A	A	B	B	C	C	D
2nd choice	D	B	C	C	B	D	C
3rd choice	B	C	D	A	D	B	B
4th choice	C	D	A	D	A	A	A

Find the winner using:

1. Condorcet's method.

   (a) A (b) B (c) C (d) D (e) none

2. Plurality Voting.

   (a) A (b) B (c) C (d) D (e) none

3. The Borda count.

   (a) A (b) B (c) C (d) D (e) none

4. Sequential pairwise voting with agenda A, B, C, D.

   (a) A (b) B (c) C (d) D (e) none

5. The Hare system.

   (a) A (b) B (c) C (d) D (e) none

6. Dictatorship method with the last voter is the dictator.

   (a) A (b) B (c) C (d) D (e) none

Question 4 (3 points)

Decrypt the following word using the affine cipher with $a = 17, k = 23$.

NYXT

Question 5   (3 points)
   Decrypt the following statement using Vigenére cipher with keyword "rain":

$$YPXRDVLY$$

Question 6   (5 points)
   (a) What is the encryption formula for the affine cipher?

   (b) How many different keys are there for the affine cipher?

   (c) How could Eve break the affine cipher cryptosystem (that is, can she read the encrypted message between Alice and Bob without knowing the key assuming she has a fast computer?)

Question 7 (5 points)

An initial amount of 2400 **BD** is deposited in a saving account. Moreover, 1200 **BD** is deposited annually at the end of each year. The account pays interest of 6.25% compounded annually. How much money will be in the account in 10 years?

Question 8 (10 points)

Consider a line segment of length one. In the first step, we divided it into three equal parts and we remove the middle one. In the second step, we divide each of the remaining parts into 3 equal parts and we remove the middle one from each. We continue doing that infinitely many.

1. Find a formula of the length of the removed parts in step n.

2. Find the total length of all of the removed parts.

3. Are there anything left after removing the middle parts infinitely many? Why?

4. How could you explain your findings above?

Question 9   (5 points)

(a) *Copeland's method* is a voting system where the winner is the candidate whom getting the largest number of *total* wins in one–to–one competition with every other candidate. Find the winner using Copeland's method using the ballot in Question 4. (show your work)

(b) In general, when the copeland's method yields the same winner as the condorcet's method?

A	B	C	D	E	F	G	H	I	J	K	L	M
0	1	2	3	4	5	6	7	8	9	10	11	12
N	O	P	Q	R	S	T	U	V	W	X	Y	Z
13	14	15	16	17	18	19	20	21	22	23	24	25

Table 1: The English alphabets as numbers modulo 26

a	1	3	5	7	9	11	15	17	19	21	23	25
a'	1	9	21	15	3	19	7	23	11	5	17	25

Table 2: The multiplicative inverse modulo 26