Practice Test 1. Democracy & Fractals

Math 300

Last Name	First Name	Date

This assignment is closed books. One 2-sided US Letter sheet of notes is OK.

All your scratch work will be collected with the test and discarded.

All electronic devices besides approved calculators and computers running approved software are prohibited.

Fully justify your answers and show all work
in order to maximize your partial credit.

1 (10 points)**.** The following table shows the number of employees in four divisions of a Acme corporation. There are 85 new laptops to be apportioned among the divisions.

Division	**Sales**	**Advertizing**	**Service**	**Manufacturing**	**Total**
Personnel	1008	234	625	3114	
Quotient					
Standard Quota					

(a) Find the standard divisor.

(b) Find the quotient and the standard quota for each region an fill out the table above.

(c) Use the Hamilton method to apportion the laptops.

Division	**Sales**	**Advertizing**	**Service**	**Manufacturing**
Laptops				

(d) Circle an appropriate modified standard divisor for the Jefferson method:

56 57 58

(e) Use the Jefferson method to apportion the laptops.

Division	**Sales**	**Advertizing**	**Service**	**Manufacturing**
Quotient				
Laptops				

2 (10 points)**.** A company with offices across the country will hold its annual executive meeting in one of four locations. Executives were asked to rank locations in order of preference. The results are shown in the preference schedule below.

City	**Rankings**			
New York	3	1	2	2
Dallas	2	3	1	4
Los Angeles	4	2	4	1
Atlanta	1	4	3	3
Number of Votes	**19**	**24**	**7**	**35**

(a) Using the plurality voting system, which location is the winner of the company vote?

(b) Is there a majority winner?

(c) Use the Pairwise Comparison method to determine the winner. Construct the table showing the outcome of every match-up, and fill it out completely.

3 (8 points)**.** A teaching assistant is preparing a tutoring session schedule. She asks students to rank times of day in order of preference. The results are shown in the preference schedule below. Use the Borda method to determine the winner. Show all work, including the Borda point tallies for each time of day.

Time	**Rankings**				
Morning	4	1	4	2	3
Noon	3	2	2	3	1
Afternoon	1	3	1	4	2
Evening	2	4	3	1	4
Number of Votes	**12**	**16**	**9**	**5**	**13**

4 (8 points)**.** Using the Plurality With Elimination system (also known as Instant Runoff Voting), which meeting time is the winner of the student vote? Show all work, including the updated preference schedule after each elimination.

Time	**Rankings**				
Morning	4	1	4	2	3
Noon	3	2	2	3	1
Afternoon	1	3	1	4	2
Evening	2	4	3	1	4
Number of Votes	**12**	**16**	**9**	**5**	**13**

5 (8 points)**.** Convert the given number into base 10. Show work.

(a) 21012_3

(b) 666_9

(c) $CAFE_{16}$

(d) 101.101_2

6 (3 points). Write 100 in base 2. Show work.

7 (3 points). Write 88 in base 7. Show work.

8 (3 points). Write 1000 in base 5. Show work.

9 (3 points). Write 1776 in base 16. Show work.

10 (10 points)**.** For each expression, perform the multiplication and simplify the result by combining like terms. Show all work.

(a) $(10x-4y)(5x+6y)$

(b) $(1+10x+100x^2)(1-x+x^2)$

11 (10 points)**.** Rewrite each expression in a factored form, after factoring out the GCF.

(a) $27 - 30a$

(b) $120b^7 + 144b^3$

(c) $12c^2d - 30cd^2$

(d) $10k + 100k^2 + 1000k^3$

(e) $x^4y^2z^3 + x^3y^5z^2 + x^3y^4z^3$

12 (8 points). A sequence is defined by

$$\begin{aligned} a_1 &= 1 \\ a_2 &= 2 \\ a_3 &= 3 \\ a_n &= a_{n-1} - a_{n-2} + a_{n-3} \text{ if } n > 3 \end{aligned}$$

Find the following members of the sequence. Show work.

$a_4 =$

$a_5 =$

$a_6 =$

$a_7 =$

13 (10 points). Simplify and state the answer in the standard form $a + bi$:

(a) $(6+7i)(7-6i)$

(b) $(-i)^{1917}$

(c) $\dfrac{25+15i}{3-i}$

14 (6 points). A sequence is defined by

$$z_1 = 3+4i$$

$$z_n = i(2-z_{n-1}) \text{ if } n>1$$

Find the following members of this sequence and state them in the standard form $a+bi$. Show work.

(a) $z_2 =$

(b) $z_3 =$

(c) $z_4 =$

TOTAL POINTS: 100