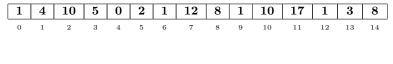# CENG111 Mock THE1 Test

Hasan Hüseyin Yıldız, Yiğithan Tamer

November 19, 2020

1 Problem
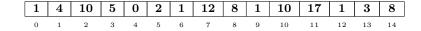
Using the instructions for the "THE Machine" and the number sequence given below, compute the final number sequence.

1	4	10	5	0	2	1	12	8	1	10	17	1	3	8
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14

38	0	3	13	9	23	3	38	4	13	13	8	38	3	1
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29

2	1	12	8	1	10	21	0	1
30	31	32	33	34	35	36	37	38

2 Solution

Cycle 1

R_1	R_2	I
0	0	0

1	4	10	5	0	2	1	12	8	1	10	17	1	3	8
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14

38	0	3	13	9	23	3	38	4	13	13	8	38	3	1
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29

2	1	12	8	1	10	21	0	1
30	31	32	33	34	35	36	37	38

Cycle 2

R_1	R_2	I
4	0	2

1	4	10	5	0	2	1	12	8	1	10	17	1	3	8
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14

1

38	0	3	13	9	23	3	38	4	13	13	8	38	3	1
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29

2	1	12	8	1	10	21	0	1
30	31	32	33	34	35	36	37	38

Cycle 3

R_1	R_2	I
4	0	5

1	4	10	5	0	2	1	12	8	1	10	17	1	3	8
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14

38	0	3	13	9	23	3	38	4	13	13	8	38	3	1
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29

2	1	12	8	1	10	21	0	1
30	31	32	33	34	35	36	37	38

Cycle 4

R_1	R_2	I
4	1	7

1	4	10	5	0	2	1	12	8	1	10	17	1	3	8
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14

38	0	3	13	9	23	3	38	4	13	13	8	38	3	1
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29

2	1	12	8	1	10	21	0	1
30	31	32	33	34	35	36	37	38

Cycle 5

R_1	R_2	I
3	1	8

1	4	10	5	0	2	1	12	8	1	10	17	1	3	8
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14

38	0	3	13	9	23	3	38	4	13	13	8	38	3	1
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29

2	1	12	8	1	10	21	0	1
30	31	32	33	34	35	36	37	38

Cycle 6

R_1	R_2	I
3	1	10

1	3	10	5	0	2	1	12	8	1	10	17	1	3	8
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14

38	0	3	13	9	23	3	38	4	13	13	8	38	3	1
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29

2	1	12	8	1	10	21	0	1
30	31	32	33	34	35	36	37	38

Cycle 7

R_1	R_2	I
3	1	17

1	3	10	5	0	2	1	12	8	1	10	17	1	3	8
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14

38	0	3	13	9	23	3	38	4	13	13	8	38	3	1
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29

2	1	12	8	1	10	21	0	1
30	31	32	33	34	35	36	37	38

Cycle 8

	R_1	R_2	I
	3	1	19

1	3	10	5	0	2	1	12	8	1	10	17	1	3	8
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14

38	0	3	13	9	23	3	38	4	13	13	8	38	3	1
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29

2	1	12	8	1	10	21	0	1
30	31	32	33	34	35	36	37	38

Cycle 9

	R_1	R_2	I
	3	1	23

1	3	10	5	0	2	1	12	8	1	10	17	1	3	8
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14

38	0	3	13	9	23	3	38	4	13	13	8	38	3	1
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29

2	1	12	8	1	10	21	0	1
30	31	32	33	34	35	36	37	38

Cycle 10

	R_1	R_2	I
	3	3	25

1	3	10	5	0	2	1	12	8	1	10	17	1	3	8
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14

4

38	0	3	13	9	23	3	38	4	13	13	8	38	3	1
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29

2	1	12	8	1	10	21	0	1
30	31	32	33	34	35	36	37	38

Cycle 11

R_1	R_2	I
9	3	26

1	3	10	5	0	2	1	12	8	1	10	17	1	3	8
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14

38	0	3	13	9	23	3	38	4	13	13	8	38	3	1
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29

2	1	12	8	1	10	21	0	1
30	31	32	33	34	35	36	37	38

Cycle 12

R_1	R_2	I
9	3	28

1	3	10	5	0	2	1	12	8	1	10	17	1	3	8
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14

38	0	3	13	9	23	3	38	4	13	13	8	38	3	1
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29

2	1	12	8	1	10	21	0	9
30	31	32	33	34	35	36	37	38

Cycle 13

R_1	R_2	I
3	3	30

1	3	10	5	0	2	1	12	8	1	10	17	1	3	8
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14

38	0	3	13	9	23	3	38	4	13	13	8	38	3	1
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29

2	1	12	8	1	10	21	0	9
30	31	32	33	34	35	36	37	38

Cycle 14

R_1	R_2	I
3	1	32

1	3	10	5	0	2	1	12	8	1	10	17	1	3	8
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14

38	0	3	13	9	23	3	38	4	13	13	8	38	3	1
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29

2	1	12	8	1	10	21	0	9
30	31	32	33	34	35	36	37	38

Cycle 15

R_1	R_2	I
2	1	33

1	3	10	5	0	2	1	12	8	1	10	17	1	3	8
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14

38	0	3	13	9	23	3	38	4	13	13	8	38	3	1
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29

2	1	12	8	1	10	21	0	9
30	31	32	33	34	35	36	37	38

6

Cycle 16

	R_1	R_2	I
	2	1	35

1	2	10	5	0	2	1	12	8	1	10	17	1	3	8
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14

38	0	3	13	9	23	3	38	4	13	13	8	38	3	1
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29

2	1	12	8	1	10	21	0	9
30	31	32	33	34	35	36	37	38

Cycle 17

	R_1	R_2	I
	2	1	21

1	2	10	5	0	2	1	12	8	1	10	17	1	3	8
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14

38	0	3	13	9	23	3	38	4	13	13	8	38	3	1
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29

2	1	12	8	1	10	21	0	9
30	31	32	33	34	35	36	37	38

Cycle 18

	R_1	R_2	I
	9	1	23

1	2	10	5	0	2	1	12	8	1	10	17	1	3	8
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14

38	0	3	13	9	23	3	38	4	13	13	8	38	3	1
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29

2	1	12	8	1	10	21	0	9
30	31	32	33	34	35	36	37	38

Cycle 19

R_1 R_2 I

9		3		25

1	2	10	5	0	2	1	12	8	1	10	17	1	3	8
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14

38	0	3	13	9	23	3	38	4	13	13	8	38	3	1
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29

2	1	12	8	1	10	21	0	9
30	31	32	33	34	35	36	37	38

Cycle 20

R_1 R_2 I

27		3		26

1	2	10	5	0	2	1	12	8	1	10	17	1	3	8
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14

38	0	3	13	9	23	3	38	4	13	13	8	38	3	1
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29

2	1	12	8	1	10	21	0	9
30	31	32	33	34	35	36	37	38

Cycle 21

R_1 R_2 I

27		3		28

1	2	10	5	0	2	1	12	8	1	10	17	1	3	8
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14

38	0	3	13	9	23	3	38	4	13	13	8	38	3	1
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29

2	1	12	8	1	10	21	0	27
30	31	32	33	34	35	36	37	38

Cycle 22

R_1	R_2	I
2	3	30

1	2	10	5	0	2	1	12	8	1	10	17	1	3	8
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14

38	0	3	13	9	23	3	38	4	13	13	8	38	3	1
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29

2	1	12	8	1	10	21	0	27
30	31	32	33	34	35	36	37	38

Cycle 23

R_1	R_2	I
2	1	32

1	2	10	5	0	2	1	12	8	1	10	17	1	3	8
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14

38	0	3	13	9	23	3	38	4	13	13	8	38	3	1
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29

2	1	12	8	1	10	21	0	27
30	31	32	33	34	35	36	37	38

Cycle 24

	R_1	R_2	I
	1	1	33

1	2	10	5	0	2	1	12	8	1	10	17	1	3	8
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14

38	0	3	13	9	23	3	38	4	13	13	8	38	3	1
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29

2	1	12	8	1	10	21	0	27
30	31	32	33	34	35	36	37	38

Cycle 25

	R_1	R_2	I
	1	1	35

1	1	10	5	0	2	1	12	8	1	10	17	1	3	8
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14

38	0	3	13	9	23	3	38	4	13	13	8	38	3	1
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29

2	1	12	8	1	10	21	0	27
30	31	32	33	34	35	36	37	38

Cycle 26

	R_1	R_2	I
	1	1	21

1	1	10	5	0	2	1	12	8	1	10	17	1	3	8
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14

10

38	0	3	13	9	23	3	38	4	13	13	8	38	3	1
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29

2	1	12	8	1	10	21	0	27
30	31	32	33	34	35	36	37	38

Cycle 27

R_1	R_2	I
27	1	23

1	1	10	5	0	2	1	12	8	1	10	17	1	3	8
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14

38	0	3	13	9	23	3	38	4	13	13	8	38	3	1
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29

2	1	12	8	1	10	21	0	27
30	31	32	33	34	35	36	37	38

Cycle 28

R_1	R_2	I
27	3	25

1	1	10	5	0	2	1	12	8	1	10	17	1	3	8
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14

38	0	3	13	9	23	3	38	4	13	13	8	38	3	1
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29

2	1	12	8	1	10	21	0	27
30	31	32	33	34	35	36	37	38

Cycle 29

R_1	R_2	I
81	3	26

1	1	10	5	0	2	1	12	8	1	10	17	1	3	8
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14

38	0	3	13	9	23	3	38	4	13	13	8	38	3	1
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29

2	1	12	8	1	10	21	0	27
30	31	32	33	34	35	36	37	38

Cycle 30

R_1	R_2	I
81	3	28

1	1	10	5	0	2	1	12	8	1	10	17	1	3	8
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14

38	0	3	13	9	23	3	38	4	13	13	8	38	3	1
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29

2	1	12	8	1	10	21	0	81
30	31	32	33	34	35	36	37	38

Cycle 31

R_1	R_2	I
1	3	30

1	1	10	5	0	2	1	12	8	1	10	17	1	3	8
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14

38	0	3	13	9	23	3	38	4	13	13	8	38	3	1
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29

2	1	12	8	1	10	21	0	81
30	31	32	33	34	35	36	37	38

Cycle 32

	R_1	R_2	I
	1	1	32

1	1	10	5	0	2	1	12	8	1	10	17	1	3	8
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14

38	0	3	13	9	23	3	38	4	13	13	8	38	3	1
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29

2	1	12	8	1	10	21	0	81
30	31	32	33	34	35	36	37	38

Cycle 33

	R_1	R_2	I
	0	1	33

1	1	10	5	0	2	1	12	8	1	10	17	1	3	8
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14

38	0	3	13	9	23	3	38	4	13	13	8	38	3	1
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29

2	1	12	8	1	10	21	0	81
30	31	32	33	34	35	36	37	38

Cycle 34

	R_1	R_2	I
	0	1	35

1	0	10	5	0	2	1	12	8	1	10	17	1	3	8
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14

38	0	3	13	9	23	3	38	4	13	13	8	38	3	1
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29

2	1	12	8	1	10	21	0	81
30	31	32	33	34	35	36	37	38

Cycle 35

$$R_1 \quad R_2 \quad I$$

0		1		37

1	0	10	5	0	2	1	12	8	1	10	17	1	3	8
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14

38	0	3	13	9	23	3	38	4	13	13	8	38	3	1
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29

2	1	12	8	1	10	21	0	81
30	31	32	33	34	35	36	37	38

3 Result

After 35 cycles, we obtain the following sequence.

1	0	10	5	0	2	1	12	8	1	10	17	1	3	8
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14

38	0	3	13	9	23	3	38	4	13	13	8	38	3	1
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29

2	1	12	8	1	10	21	0	81
30	31	32	33	34	35	36	37	38

We can observe that [38] in the final sequence equals to [13] raised to the power of [1] in the initial sequence. We can modify [1] and [13] to obtain different powers in [38].