Arithmetic and Combinatorics

Training problems for M1 2018 term 1

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1 Calculating prodigies

- **1.** "He who refuses to do arithmetic is doomed to talk nonsense." Which famous computer scientist said that? You can use the internet to find out.
- 2. Which famous American calculating prodigy became an astronomer when he grew up?
- **3.** This prodigy was from Germany. He could multiply 100-digit numbers in his head. Who was he?
- **4.** Write down a few interesting things about the life of Jedediah Buxton. Where was he from? When was he born? How did he die? What did he do?
- **5.** What do the amazing powers of calculating prodigies prove about the human mind? Tell me some opinions.

2 Euclidean division

- **6.** Who was Euclid and where was he from? When did he live?
- 7. Use the terms dividend, divisor, remainder and quotient to label the parts of the expression

$$29 = 4 \times 6 + 5$$
.

Choose the divisor carefully. Is it 4 or is it 5? Check that $0 \le r < d$. Is it true? Is this a correct expression of Euclidean division?

8. Check that $0 \le r < d$. Is it true?

$$111 = 9 \times 11 + 12$$

Is this a correct expression of Euclidean division?

- **9.** Label the parts of these expressions with the terms *dividend*, *divisor*, *remainder* and *quotient*.
 - (a) 101/39.
 - (b) $m = q \times d + r, \ 0 \le r < d.$
 - (c) $59 = 5 \times 11 + 4$.

- (d) $a = b \times c + d$, $0 \le d < c$, d > b.
- (e) $r \div s$.
- (f) 39/101.

10.	Which	number	is the	divisor	and	which	one is	the c	quotient?

(a)
$$42 = 11 \times 3 + 9$$
.

(c)
$$69 = 10 \times 6 + 9$$
.

(b)
$$99 = 7 \times 13 + 8$$
.

(d)
$$23 = 4 \times 5 + 3$$
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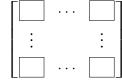
11. Do by Euclidean division. Label all the parts of your expressions. Give a clear answer in terms of two numbers.

- (a) 99/91.
- (c) 1001/651.
- (e) 19/1.
- (g) 0/15.

- (b) 919/7.
- (d) 1/19.
- (f) 17/17.
- (h) 15/0.

12. These matrices are filled with consecutive integers 0, 1, 2, . . . Figure out what goes into the boxes.

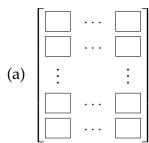
- (a) 7×7 matrix.
- (b) 10×10 matrix.
- (c) $n \times n$ matrix.

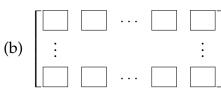


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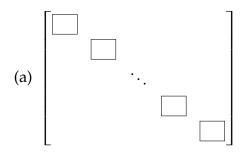
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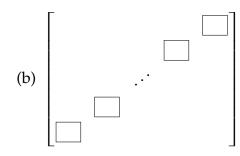
13. Each matrix is $n \times n$ and is filled with consecutive integers $0, 1, 2, \ldots$ Figure out what goes into the boxes.



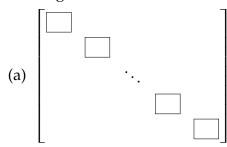


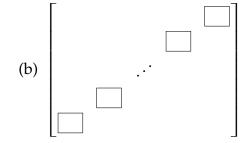
14. For a 6×6 matrix filled with consecutive integers $0, 1, 2, \ldots$, find out what goes into the boxes.





15. Now, these are $n \times n$ square matrices filled with consecutive integers $0, 1, 2, \ldots$ Figure out what goes into the boxes.





Euclidean division 3

16. Fill in the boxes for a 100	× 100 matrix of consecutive inte	egers 0, 1, 2,			
17. Consider a 30×30 matrix Give the row and column. Use	filled with consecutive integers e Euclidean division.	s starting at 0. Where is 611?			
18. Consider a 99×99 matrix column position of 3333.	of consecutive integers starting	g at zero. Find the row and			
19. Given an 80×80 matrix of the given position:	of consective numbers beginnin	g at 0, find the number is at			
(a) row 25, column 68.	(b) row 68,	column 25.			
20. In a 5000 × 5000 matrix of column 599?	of consective integers 0, 1, 2, ,	what number is at row 991,			
21. Make base-10 Euclidean d	livision tables for these numbers	S.			
(a) 3351.	(b) 4096.	(c) 12801.			
22. Change these numbers int	to base-2 by making $d = 2$ Euclid	dean division tables.			
(a) 3351.	(b) 4096.	(c) 12801.			
23. What is an algorithm? Explain it in your own words. Give some examples.					