

1 Chicken Nuggets

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1. In the U.K., Chicken Nuggets are sold in "ShareBox" packs of 6, 9 or 20. Is it possible to order exactly 30 chicken nuggets? What about 37? 38?
2. What is the largest number of chicken nuggets that you CANNOT buy in the U.K. ?
3. A Happy Meal in the U.K. includes a pack of 4 nuggets. So if you are willing to buy Happy Meals, you can get packs of 4, 6, 9, or 20. Now what is the largest number of unpurchasable chicken nuggets?
4. In the U.S., chicken nuggets are sold in packs of 4, 6, 10, 20 and 50. What is the a largest number that of nuggets that can't be purchased in the U.S.?
5. If nuggets come in packs of size x and y , then what has to be true about the numbers x and y for there to be a largest number that can't be purchased?
6. If chicken nuggets come in packs of size x and y , we'll call the largest unpurchasable number the "chicken nugget number" of x and y and write it as $C(x, y)$.

Experiment with different values of x and y , and find $C(x, y)$.

It may help to write out the numbers in rows of length x , where x is the smaller of the two numbers. For example, if x and y are 5 and 9, you could write out the numbers like this:

1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25
26	27	28	29	30
31	32	33	34	35
36	37	38	39	40
41	42	43	44	45
46	47	48	49	50
51	52	53	54	55

Then cross out purchasable numbers to see what is left.

7. Write down a formula for $C(x, y)$ in terms of x and y and explain / prove why this formula works.
8. Bay Area Rapid food sells chicken nuggets. You can buy packages of 11 or 7. What is the largest integer n such that there is no way to buy exactly n nuggets?

¹Some of these problems are from the Art of Problem Solving

9. Suppose a football league has only scores of field goals (3 points) and touchdowns with the extra point (7 points). Then what is the greatest score that cannot be the score of a team in this football game (ignoring time constraints)?
10. In the National Football League, the only way for a team to score exactly one point is if a safety is awarded against the opposing team when they attempt to convert after a touchdown. Two points are awarded for safeties from regular play, and 3 points are awarded for field goals. What pairs of scores for the two teams are possible and which are impossible (ignoring time constraints).
11. Suppose the envelope can hold ONLY three stamps, and the available stamp values are 1 cent, 2 cents, 5 cents, and 20 cents. What is the SMALLEST amount of postage that cannot be placed on an envelope?
12. Ninety-four bricks, each measuring $4 \times 10 \times 19$ inches are to be stacked one on top of another to form a tower 94 bricks tall. Each brick can be oriented so it contributes 4 inches or 10 inches or 19 inches to the total height of the tower. How many different tower heights can be achieved using all ninety-four of the bricks?
13. Find the sum of all positive integers n such that, given an unlimited supply of stamps of denominations 5, n , and $n + 1$ cents, 91 cents is the greatest postage that cannot be formed.