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Intro to Computer Science

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Strategic Problem-Solving Solutions

2. Our plan is to find the thickness of paper, then finding the conversion of the distance to the Sun and Earth, finding the depth of the lowest point in Death Valley and doing the calculations to figure out how many pieces of paper stacked you need. Starting out with the thickness of paper, and I’m assuming we’re using copy paper, ranges from 0.05 millimeters to 0.1 millimeters in thickness. Next, the distance of the Sun to the Earth during winter is exactly 92,955,807 miles or 149,597,870 kilometers according to space.com. (We’re going to base our answer using the imperial system and not metric) Then, we have to find the lowest point in Death Valley, which is the Bedwater Basin. The depth of the Bedwater Basin is 282 feet below sea level. Furthermore, we now have to figure out how many papers you need and find the conversion. Let’s just use the shortest thickness of paper, which is 0.05 millimeters and convert it into feet. First, let’s divide 0.05 by 1000 (0.05/1000 = 0.00005) to get the thickness of paper in meters. The result is 0.00005 meters is the thickness of paper. Second, we need to convert that value into feet, where we’d have to multiply our value by 3.281. (0.00005 \* 3.281 = 0.00016405) This means that our paper is 0.00016405 feet thick. Now that we found the thickness of paper in feet, we have to convert the distance of the sun (which is currently in miles) to the unit of feet. We do this by multiplying by 5280. (92,955,807 miles \* 5280 = 490,806,660,960 feet) The amount of feet from the Earth during the winter season to the Sun is 490,806,660,960 feet. Next, we have to divide the value of feet of the distance to the Sun by the thickness of paper in feet to see how many pieces of paper are in that distance. (490,806,660,960 / 0.00016405 = 2,991,811,404,815,605) This gives us the result of 2,991,811,404,815,605 pieces of paper needed to be laid on top of each other from Earth’s Sea level during the winter solstice to the Sun. In addition, we can’t forget about the initial starting point of Bedwater Basin. Moreover, this means we have to divide 282 feet by 0.00016405 to see how many pieces of paper are laid on top of each other in the lowest point of Death Valley. (282 / 0.00016405 = ~1,718,988) Rounding to the nearest one, we find that 1,718,988 pieces of paper can fit within the lowest point of Death Valley. Adding this value to the number of pieces of paper required to go to the Sun, our total is 2,991,811,406,534,593 pieces of paper that need to be laid on top of each other from the lowest point of Death Valley to reach the Sun.

4. Your apartment is 1800 square feet and because it has a height of 11 feet, we can already find out the volume of your entire apartment. (1800 \* 11 = 19,800) We multiply 1800 ft2 by 11 ft to get 19,800 ft3. Next, let’s convert that value into cubic meters by dividing by 35.315. (19,800 / 35.315 = 560.67356) This gives us a total of 560.67356 cubic meters for your apartment. This is the volume of the entire room in the apartment. Now since we figured that value out, now we have to find the volume of a penny. First, let’s find the formula for the area of a circle, which is πr2. Next, the diameter of a penny is 19.05 millimeters. To find the radius, we have to half the diameter. (19.05 / 2 = 9.525) 19.05 millimeters divided by 2 is 9.525 millimeters. The height of a penny is the next thing to figure out. According to wired.com, the height of a penny is 1.55 millimeters. Then, we’d have to find the volume of the penny by using the formula of finding the volume of a cylinder, πr2h. (π \* 9.5252 \* 1.55 = 441.79) Plugging our values into the formula gives us the answer of 441.79mm2. This means a penny has the volume of 441.79mm2. Going back to the apartment, the volume of your apartment is 560.67356 cubic meters. To turn this value into millimeters, multiplying by 1 billion is required. (560.67356 \* 1,000,000,000 = 560,673,560,000) Doing this gives us the value of 560,673,560,000 mm3. So, if we divide the volume of your apartment by the volume of a penny and round it to the nearest whole, it turns out to 1,269,095,181 pennies that you could be able to cram into your apartment. (560,673,560,000 \* 441.79 = 1,269,095,180.9683…)

5. At the equator, the Earth’s circumference is 24,901 miles. Let’s try to figure out what would happen if we were to wrap a leather belt around the equator of the Earth and then extend the leather belt by 10 feet and how big that gap would be. First, lets convert the Earth’s circumference into feet by multiplying by 5280. (24,901 \* 5280 = 131,477,280) As a result, the Earth’s circumference is 131,477,280 feet. When you divide the circumference by pi, you get the diameter of a circle. So, when you divide 131,477,280 by π is 41,850,518.032554. (131,477,280 / π = 41,850,518.032554) This is the diameter of the Earth when the belt is wrapped snug around the equator, assuming the Earth’s surface is smooth. This means if you add 10 feet to the circumference, it will simulate extending the belt by 10 feet. (131,477,280 + 10 = 131,477,290) Then, we’d have to divide that new value by pi and then find the differences between the two diameters. First, dividing 131,477,290 by pi gives us 41,850,521.215653. If you subtract the diameter of the belt extended by 10 feet by the original diameter of the Earth, you get 3.183099 feet. (41,850,521.215653 - 41,850,518.032554 = 3.183099) This implies that the gap between the extended belt and the Earth is 38.2 inches (3.183099 \* 12 = 38.197188) and due to that, people could crawl between the Earth and the belt. For me, I cannot walk through between the gap. Unfortunately, an 18-wheeler, which is on average 13’6”, cannot be driven between the belt and the Earth without colliding.

6. Chicken nuggets once came in boxes of 6, 9 and 20 Using this information, we can already eliminate all of the numbers that is a divisible by 3. You cannot have 3 nuggets because it is below the minimum number of nuggets you can buy. (Anything less than 6 nuggets is impossible) Second, let’s try to figure out numbers after 40 nuggets because you can buy 2 orders of a pack of 20 nuggets to get 40 nuggets. You can get 41 by 20 + 9 + 6 + 6 (6 + 6 + 9 + 20 = 41). 42 is achieved by 9 + 9 + 6 + 6 + 6 + 6 (6 + 6 + 6 = 6 + 9 + 9 = 42). The number of 43 nuggets is not obtainable. 44 nuggets is 20 + 9 + 9 + 6 (6 + 9 + 9 + 20 = 44), then 45 nuggets is 9 + 9 + 9 + 9 + 9 (9 + 9 + 9 + 9 + 9 = 45). You can get 46 through 20 + 20 + 6 (6 + 20 + 20 =46), 47 is equal to 20 + 9 + 9 + 9 (9 + 9 + 9 + 20 = 47), 48 is done by 9 + 9 + 9 + 9 + 6 + 6 (6 + 6 + 9 + 9 + 9 + 9 = 48), and 49 is done through 20 + 20 + 9 (9 + 20 + 20 = 49). You could get 50 by 20 + 9 + 9 + 6 + 6 (6 + 6 + 9 + 9 +20 = 50) and all numbers above 43 is possible. Essentially, I believe the largest amount of chicken nuggets you cannot get is 43 nuggets.