1. Recall that $10^n = \underbrace{100\ldots00}_{n\text{ zeros}}$, hence $10^{10} + 10^8 + 10^6 + 10^4 + 10^2 + 10^0 = \boxed{10101010101}$.

2. There are simply $6 - 4 = \boxed{2}$ apples remaining.

3. Notice that $9 \cdot 18 = 162$ and $9 \cdot 19 = 171$. Any other multiple of 9 will be further away from 169, so our answer is the closer of the two - $\boxed{171}$.

4. Since $\frac{3+6+9}{2+4+6} = \frac{18}{12} = \frac{3}{2}$ and $\frac{2+4+6}{3+6+9} = \frac{12}{18} = \frac{2}{3}$, the answer is $\frac{3}{2} - \frac{2}{3} = \boxed{\frac{5}{6}}$.

5. Since every flower has 7 petals, and Alex has 1001 petals, there are $\frac{1001}{7} = \boxed{143}$ flowers.

6. There are 16 words in the sentence, and exactly 5 of them have four letters, as shown: "**What** is the probability **that** a randomly chosen **word** of **this** sentence has exactly **four** letters?"

   Therefore, the desired probability is simply $\boxed{\dfrac{5}{16}}$.

7. 5 years ago, I was 8 years old, at which point my brother must have been 4 years old. Thus, today he is $\boxed{9}$ years old.

8. Applying the definition, we have $2\#0 = 2 \cdot 0 - 2 - 3 = -5$ and $1\#4 = 1 \cdot 4 - 1 - 3 = 0$. Thus,

$$(2\#0)\#(1\#4) = 5\#0 = (-5) \cdot 0 - (-5) - 3 = \boxed{2}.$$

9. Every time Leo says a word, there will either be 1 bark or 2 barks. Hence there are least 15 barks. Every time Leo says "puppies" this number increases by 1, hence he said "puppies" $22 - 15 = \boxed{7}$ times.

10. We can prime factorize $12 = 2^2 \cdot 3$ and $18 = 2 \cdot 3^2$. Hence, since the greatest common divisor takes the smallest exponent of each prime, we have $\gcd(12, 18) = 2 \cdot 3 = 6$. Similarly, since the least common multiple takes the largest exponent of each prime, we have $\text{lcm}(12, 18) = 2^2 \cdot 3^2 = 36$. Thus our answer is $6 + 36 = \boxed{42}$.

    Alternatively, we can utilize the Euclidean Algorithm to find $\gcd(12, 18) = \gcd(12, 6) = \gcd(6, 6) = 6$, then use $\text{lcm}(x, y) = \dfrac{xy}{\gcd(x, y)}$ to find $\text{lcm}(12, 18) = \dfrac{12 \cdot 18}{6} = 36$. Our answer is then the same as before.

11. Evan's 12th grade score was greater than $8 \cdot 5 = 40$, but was less than 42. The only integer between these is $\boxed{41}$.

12. After 5 days, the hedgehog has made $5 \cdot 5 = 25$ new friends, for a total of $4+25 = \boxed{29}$. Alternatively, in general the hedgehog will have $5(n-1)+4 = 5n-1$ friends on day n by the same logic, so when $n = 6$ he will have 29 friends.

13. The 7 smallest prime numbers are $2, 3, 5, 7, 11, 13$, and 17, the sum of which is $\boxed{58}$.

14. Let the number in question be x. Then we know

$$21 + \frac{1}{4}x = \frac{3}{5}x \implies 21 = \left(\frac{3}{5} - \frac{1}{4}\right)x$$

$$\implies 21 = \left(\frac{12}{20} - \frac{5}{20}\right)x = \left(\frac{7}{20}\right)x$$

$$\implies x = 21 \cdot \frac{20}{7} = \boxed{60}.$$

Verifying, $\frac{1}{4}$ of 60 is 15, and $\frac{3}{5}$ of 60 is 36. As $21 + 15$ is indeed equal to 36, this check is successful.

15. We have $0^2 = 0, 1^2 = 1, 2^2 = 4, 3^2 = 9, 4^2 = 16, 5^2 = 5, 6^2 = 36, 7^2 = 49, 8^2 = 64$, and $9^2 = 81$. Any other perfect squares will have the same last digit as one of these, so the possible last digits are 0, 1, 4, 5, 6, and 9. There are $\boxed{6}$ of these.

16. Since five students take both languages, 27-5=22 students take French only and 32-5=27 students take Spanish only. Hence a total of $22 + 27 = \boxed{49}$ students take exactly 1 language course.

17. Suppose there are g girls in the room. Then there are $2g$ teachers and $g + 6$ boys in the room, for a total of $4g + 6 = 38$ people. Thus $g = 8$, and there are $8 + (8 + 6) = \boxed{22}$ children.

18. If Alex writes x more problems, then he will have written a total of $61 + x$ of the $187 + x$ problems. Hence

$$\frac{61 + x}{187 + x} = \frac{1}{2}$$

$$\implies 122 + 2x = 187 + x$$

$$\implies x = \boxed{65}$$

19. Since 2 darps is equal to 4 derps, 6 darps is equal to 12 derps. Similarly, since 3 derps is equal to 5 dirps, 12 derps is equal to 20 dirps. Hence, 6 darps is equivalent to $\boxed{20}$ dirps.

20. Since the length of Alex's rectangle and the width of Alex's rectangle are both 3 times the length and width of Kelvin's rectangle, the area of Alex's rectangle is $3 \cdot 3 = 9$ times the area of Kelvin's rectangle. Hence the area of Alex's rectangle is $9 \cdot 12 = \boxed{108}$.

21. We have $2 \star 2 = 2^2 + 2^2 = 4 + 4 = 8$, and thus $2 \star (2 \star 2) = 2 \star 8 = 2^8 + 8^2 = 256 + 64 = \boxed{320}$.

22. To mix the color purple, Rita would have to roll red once and blue once. She can either roll red first and blue next, which has a probability of $\frac{3}{6} \cdot \frac{1}{6} = \frac{1}{12}$, or roll blue first and red next, which also has a probability of $\frac{1}{6} \cdot \frac{3}{6} = \frac{1}{12}$. The final probability is thus $\frac{1}{12} + \frac{1}{12} = \boxed{\frac{1}{6}}$.

23. Let his final exam score be x. Then

$$\frac{91 + 89 + 88 + 94 + 87 + 85 + x}{7} = x$$
$$\implies \frac{534 + x}{7} = x$$
$$\implies 534 + x = 7x \implies 534 = 6x$$
$$\implies x = \boxed{89}$$

24. Let the integers be $x-2, x-1, x, x+1, x+2$. Then $5x = 210 \implies x = 42$, so the largest number is $x + 2 = 42 + 2 = \boxed{44}$.

25. Suppose the side length of the cube is s. Then the area of each face of the cube, being a square, has area s^2. Since there are 6 such faces, the surface area of the cube is $6s^2$. As such we have $6s^2 = 294 \implies s^2 = 49 \implies s = \pm 7$. Clearly $s = -7$ does not make sense as a side length, leaving the solution $s = \boxed{7}$.

26. Suppose there are a big peaches and b little peaches. Hence there are $a+b$ peaches in the pile. Considering their weights, $8a+4b = 252 \implies 2a+b = 63$. Thus $a + b = 63 - a$, so minimizing $a + b$ is the same as maximizing a. The largest possible value of a is 31, so there are $63 - 31 = \boxed{32}$ peaches in the pile.

27. In the 5 minutes that James has a hammer, he can crush 150 candies. After that, it takes him 4 seconds to crush one candy, so crushing another 30 candies takes 120 seconds - or two minutes. Thus he needs at least $5 + 2 = \boxed{7}$ minutes to crush 180 candies.

28. Let a and b be the integers, and without loss of generality assume that $a \geq b$ (if $a < b$, we can simply switch the two). Since $8 = a + b \leq 2a$, we know that a is at least 4. Furthermore, since $a^2 \leq a^2 + b^2 = 34$, we know that a is less than 6. Therefore we only need to check $a = 4$ and

$a = 5$, the latter of which leads to the solution $a = 5, b = 3$. Therefore, $ab = 5 \cdot 3 = \boxed{15}$.

29. The total score of the class beforehand is $12 \cdot 65 = 780$, and the total score afterwards is $13 \cdot 66 = 858$. Hence the new student scored a $858 - 780 = \boxed{78}$ on the test.

30. Suppose there are a alpacas and c chickens. Then $a + 2c = 94$ and $2c + 4a = 238$, so $3a = 238 - 94 = 144$. Hence $a = 48 \implies b = 23$, and thus there are $\boxed{71}$ animals on the farm.

31. Nikita catches up to Lev at the rate of 4 miles per hour, so it takes her $\boxed{15}$ minutes before she is half a mile ahead of Lev.

32. Though the top floor is labeled "88", we have skipped all the floors containing a 4. That includes the floors $4, 14, \dots, 84$ and $40, 41, \dots, 49$, of which there are 18 (there are 9 in the first list and 10 in the second, but both lists contain 44). Hence there are actually only $88 - 18 = \boxed{70}$ floors in this building.

33. The squares less than 20 are $0^2 = 0, 1^2 = 1, 2^2 = 4, 3^2 = 9$, and $4^2 = 16$. There are $\binom{5}{2} + 5 = 15$ combinations of these, but $16 + 16$ and $9 + 16 > 20$ and $0 + 0 < 1$. Hence $15 - 3 = \boxed{12}$ of these lie between 1 and 20. Notice that it is also easily verifiable that no combinations result in the same sum.

34. 5 sea otters can eat only half the amount that 10 sea otters can, but since they have $\frac{3}{2}$ the time the 10 sea otters had, they can eat $\frac{1}{2} \cdot \frac{3}{2} = \frac{3}{4}$ the amount. Hence they eat $36 \cdot \frac{3}{4} = \boxed{27}$ sea urchins.

35. The remainder upon dividing 9 by 2 is 1, so $9\%2 = 1$. Similarly, the remainder upon dividing 9 by 4 is 1, so $9\%4 = 1$. Hence $9 \triangle 2 = \frac{1+1}{2} = \boxed{1}$.

36. 7 people is not enough to guarantee this, as they could each be born on a different day of the week. However, adding one more person to that mix ensures that some two people will be born on the same day of the week, so $\boxed{8}$ people is the least number necessary.

37. The biking leg of his trip is completed in $\frac{2}{10} = \frac{1}{5}$ of an hour, or 12 minutes, while the swimming leg of his trip is completed in $\frac{3}{12} = \frac{1}{4}$ of an hour, or 15 minutes. Since the entire trip takes $\frac{6}{6} = 1$ hour, he should spend $60 - 12 - 15 = \boxed{33}$ minutes on his walk.

38. Since the triangle's altitudes are all equal, the triangle must be equilateral. Suppose the side length of this triangle is $2s$. Then, by the Pythagorean theorem, $s^2 + 6^2 = (2s)^2 \implies 36 = 3s^2 \implies 12 = s^2$. The area of the triangle is thus $\dfrac{s^2\sqrt{3}}{4} = \frac{12\sqrt{3}}{4} = \boxed{3\sqrt{3}}$.

39. Let the squares be $(x-2)^2, (x-1)^2, x^2, (x+1)^2$, and $(x+2)^2$. Their sum is $5x^2+2^2+1^2+1^2+2^2 = 5x^2+10$, hence $5x^2+10 = 146 \cdot 5 = 730$. Thus $5x^2 = 720 \implies x^2 = 144 \implies x = \pm 12$, making the smallest of these squares $\boxed{100}$.

40. If $x \leq 4$, then the median of the numbers is 4 and hence $\frac{24+x}{5} = 4 \implies x = -4$. If $4 < x < 7$, then the median of the numbers is x and hence $\frac{24+x}{5} = x \implies x = 6$. If $x \geq 7$, then the median of the numbers is 7 and hence $\frac{24+x}{5} = 7 \implies x = 11$. The sum of these three values is thus $(-4)+6+11 = \boxed{13}$.

41. Since the triangle is isosceles, some two of its side lengths are equal. Hence either $x-4 = 2x-9 \implies x = 5$, $2x-9 = 3x-15 \implies x = 6$, or $x-4 = 3x-15 \implies x = \frac{11}{2}$. However, if $x = 5$, the side lengths of the triangle are 1, 1, and 0 - clearly not a triangle. Hence the only two valid values of x are 6 and $\frac{11}{2}$, the sum of which is $\boxed{\frac{23}{2}}$.

42. Since $2014 = 2 \cdot 19 \cdot 53$, the sum of its factors is $(1+2)(1+19)(1+53) = 3 \cdot 20 \cdot 54 = \boxed{3240}$.

43. The only way that this is possible is if the children alternate in the form "GBGBGBG", where "G" denotes a girl and "B" denotes a boy. The 4 girls can arrange themselves in any of $4! = 4 \cdot 3 \cdot 2 \cdot 1 = 24$ ways, while the 3 boys can arrange themselves in $3! = 3 \cdot 2 \cdot 1 = 6$ ways. Thus there are a total of $6 \cdot 24 = \boxed{144}$ possible arrangements.

44. We will first count the numbers from 1 to 1999 that do *not* have a 6 in it. There are $2 \cdot 9 \cdot 9 \cdot 9 - 1 =$ such numbers from 1 to 1999, as there are two choices (0 or 1) for the thousands digit and nine for each of the hundreds, tens, and ones digit (excluding the case of 0000), so there are $1999 - 1457 = 542$ numbers between 1 and 1999 that do have a 6 in it. Adding in the final case of 2006, there are $\boxed{543}$ such numbers between 1 and 2014.

45. Let the number be $\overline{abc}$. If any of a, b, c are zero, then the product of the digits would be zero, implying that the sum of the digits is 0 - impossible. Hence a, b, c are all positive digits. WLOG assume that $a \leq b \leq c$ - we'll account for the permutations later. Thus we have $abc = a+b+c \leq 3c \implies ab \leq 3$, meaning we need check only $(a,b) = (1,1)$, $(a,b) = (1,2)$, and $(a,b) = (1,3)$. The former case gives us $c = 2+c$, contradiction, the second gives us $2c = 3+c \implies c = 3$, and the third gives us $3c = 4+c \implies c = 2$, a contradiction as we assumed $b \leq c$. Therefore the only possible numbers are the permutations of $\overline{123}$, of which there are $3! = \boxed{6}$.

46. There are 105 multiples of 19 between 1 and 2014, 53 of which are odd and 52 of which are even. Hence there is $\boxed{1}$ more number that is yellow and blue than yellow and orange.

47. By symmetry, the probability of hearing a "bong" n times is equal to the probability of hearing a bong $2015 - n$ times. Hence the probability of hearing a "bong" anywhere from 1008 to 2015 times, inclusive, is equal to the probability of hearing a "bong" anywhere from 0 to 1007 times, inclusive. Since these account for all the possibilites, the probability of each of these is $\boxed{\dfrac{1}{2}}$.

48. Because $18 > 12 \implies 3\sqrt{2} > 2\sqrt{3} \implies \frac{\sqrt{2}}{2} > \frac{\sqrt{3}}{3}$, we have $A > B$. Since $98 < 100 \implies 7\sqrt{2} < 10 \implies \frac{\sqrt{2}}{2} < \frac{5}{7}$, we have $A < C$. Finally, since $12 > 9 \implies 2\sqrt{3} > 3 \implies \frac{\sqrt{3}}{3} > 0.5$, hence $D < B$. Thus $D < B < A < C$, and our answer is $\boxed{DBAC}$.

49. Plugging in $x = 1$ and $x = 2$ gives us $f(1)+1\cdot f(2) = 2$ and $f(2)+2\cdot f(1) = 2$, hence $f(1) + f(2) = f(2) + 2f(1) \implies f(1) = \boxed{0}$.

50. There are $52 \cdot 51$ possible positions for these two cards. If they are next to each other, there are 51 possible places they could be in, and there are 2 ways to arrange them within each place. Hence the desired probability is $\frac{2\cdot 51}{51\cdot 52} = \frac{2}{52} = \boxed{\dfrac{1}{26}}$.