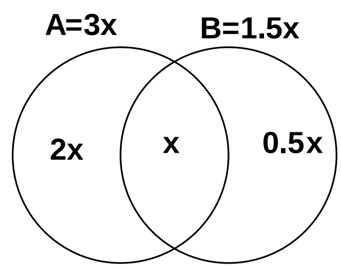
The following were changed at the resolution center at the convention: 19 E

1. C $M^3 = \begin{bmatrix} 1 & 6 & 5 & 11 \\ 5 & 3 & 9 & 2 \\ 4 & 6 & 11 & 12 \\ 7 & 7 & 15 & 7 \end{bmatrix}$, and as the number 11 is the element representing the location of (*C*, *C*), there are 11 three-step paths leading from *C* back to itself.

2. B There are 16 vertices (N_0), 32 edges (N_1), 24 faces (N_2), and 8 spaces (N_3).
$16 - 32 + 24 - 8 = 0$.

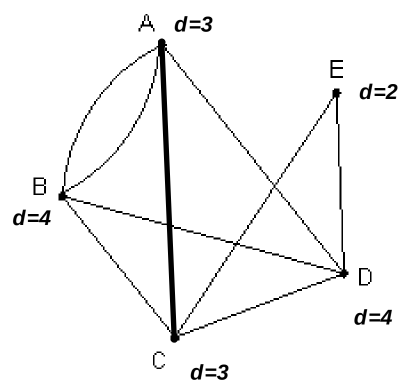
3. B Call $A \cap B$, x. Then, *A* (not including $A \cap B$) must be 2x (in order for one-third of *A*'s elements to also be in *B*). There are a total of 3x elements in *A*, so *B* must have 1.5x elements. Therefore, *B* (not including $A \cap B$) must be 0.5x. Adding all elements, we have:



$2x + x + 0.5x = 42$
$3.5x = 42$
$x = 12$ So, there are 12 elements in $A \cap B$.

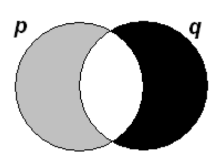
4. A x is positive, so the range for y is $x \le y \le x^2$. Therefore, the range for z must be $0 \le z \le x^2 + x$. Since the given range is 240, we solve the quadratic $x^2 + x = 240$. The only positive solution is 15.

5. B All vertices have an even degree except for vertex A (d=3) and vertex C (d=3). Therefore, the new edge must connect A-C.



6. B The chromatic number is 3. (A/C can be one color, B/E a second color, and D a third color)

7. A Both terms of the statement include $\neg p$, so that is the "region" which is shared.

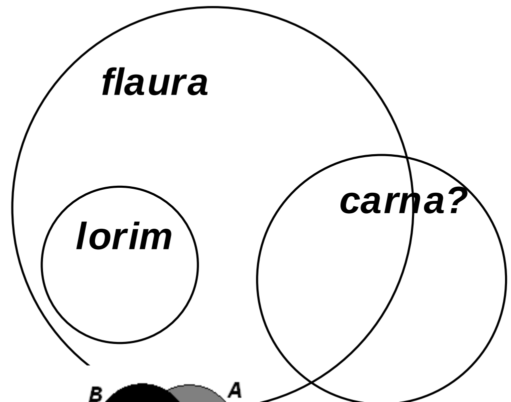


8. C By definition, if $a \equiv x \pmod{y}$, then *y* evenly divides *a*-*x*. Likewise, if $a \equiv y \pmod{x}$, then *x* evenly divides *a*-*y*. Therefore, *a* is a number that is divisible by *y* after *x* is subtracted, and vice-versa. As such, *a* must be *x*+*y*.

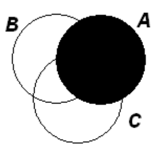
9. D
$$\frac{n^2-n}{2}-\frac{(n-2)^2-(n-2)}{2}$$
$$\frac{n^2-n}{2}-\frac{n^2-4n+4-n+2}{2}$$
$$\frac{4n-6}{2}=2n-3$$

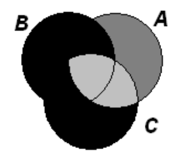
10. A The F in the 16^1 digit represents $15*16^1$, resulting in 240_{10}. The 2 is in the 16^0 digit, resulting in $2*16^0 = 2_{10}$. Together, $F2_{16} = 242_{10} = 100(2) + 10(4) + (2)$.
$2 + 4 + 2 = 8$.

11. D Since no information is given relating flaura and carna, we can only be sure that lorim and carna are mutually exclusive. Since some flaura are lorim, and we know that no lorim are carna, not all flaura can be carna.
Therefore, D is the only choice that is not possible.

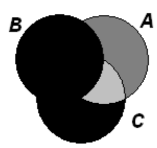


12. A Choice B is only Region A. Choice C is Regions B and C, with the intersection of A and C removed.
the



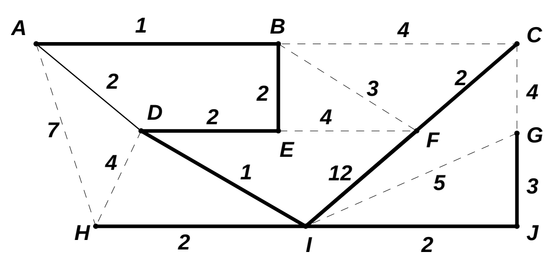


Choice D is Regions B and C, with the intersection of A and C (not including B) removed.



13. E There are 2^n subsets of a set, including the null set. The subsets can be anywhere from 0 to n elements in length. All choices are therefore subsets, so choice E is correct.

14. C The easiest way to find a MSP is by simply choosing the least expensive edges, not closing any circuits, until a MSP is formed (Kruskal's Algorithm). In this case, the MSP is represented by the thick lines in the graph. The sum of the edges = 27.



15. A The shortest path is as follows: C - B - A - D - I - H, with cost=10. There are a few (seemingly shorter) paths with cost 11.

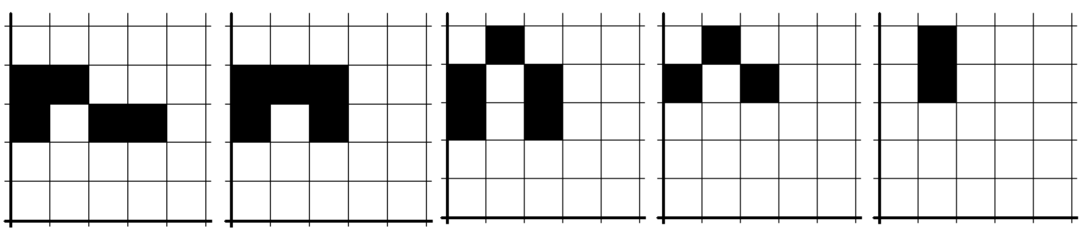
16. B Choice A violates rows 3, 4, and 6 of the table.
Choice C violates rows 1 and 4.
Choice D violates rows 1, 3, and 4.
(most of these result from the fact that if the antecedent is false, the conclusion is irrelevant and the statement must be true)

17. D With logarithmic time-complexity, the increase in speed of the algorithm slows significantly as more complex functions are included. Linear, Exponential, and Quadratic all increase with greater rate at higher algorithm complexity. (To see this, examine the derivative of a standard form of each type of function)

18. C To solve these problems, divide the given integer by increasing powers of 5, adding all the whole-number parts. So, here, we must divide 2010 by 5^1 (402), by 5^2 (80), by 5^3 (16) and by 5^4(3). 402+80+16+3 = 501.

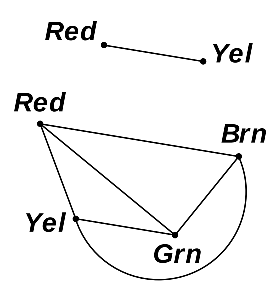
19. A Choice B can be obtained by using the following Rules: II, II, III.
Choice C by Rules II, II, III, I, II.
Choice D by Rule I.

20. B The iterations are shown below. After four iterations, there are two live cells.
iteration 0 iteration 1 iteration 2 iteration 3 iteration 4



21. B A(2, 1)= A(1, A(2, 0)) it can be shown that A(2, 0) = 3
= A(1, 3)
= A(0, A(1, 2)) it can be shown that A(1, 2) = 4
= A(0, 4)
= 5

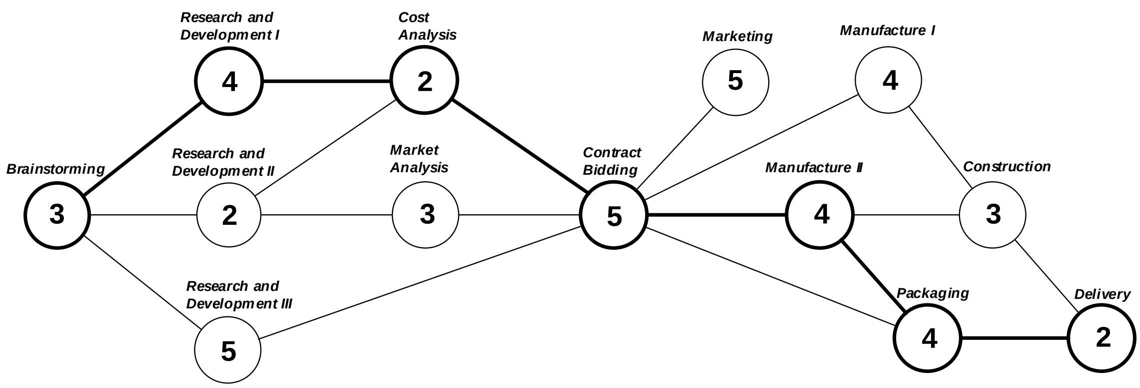
22. B The probability of choosing the correct door on the first try is 1/3 (or, 1/n for n doors). Since the host only leaves one remaining door to switch to, the probability of *that* door being correct is 2/3 (or, (n-1)/n for n doors). It is always beneficial, in the long run, to switch doors.



23. C Because the maximum chromatic number for a planar graph is four, we must only need to reach four colors to be satisfied. The graph below accomplishes that.

24. E None of the operations are commutative. Assuming A ≠ B and a ≠ b,
A. A X B ≠ B X A
B. a / b ≠ b / a
C. a - b ≠ b - a
D. a^b ≠ b^a

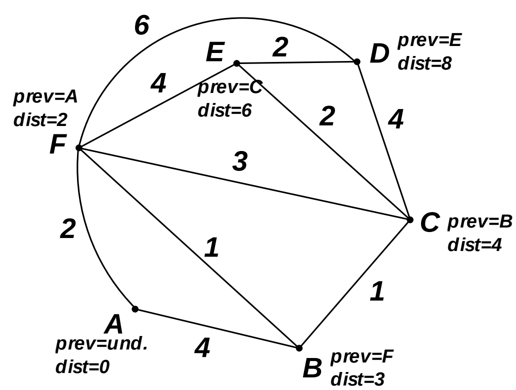
25. C The shortest path which fits the criteria is as shown. Adding the times of the necessary tasks yields a total of 24 time-units. Any other path would either take longer, or not fit the given criteria.



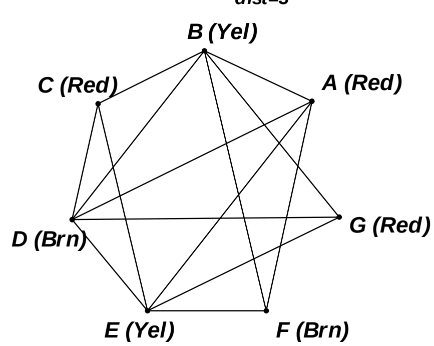
26. B Reverse Polish Notation calculates based on stacks. Each elements stacks on the others, until an operation is reached, which operates on the two prior elements in the stack. Hence,

8 5 1 3 + * 2 / - becomes
8 5 4 * 2 / -
8 20 2 / -
8 10 -
-2

27. C This algorithm is different from most variations of Djikstra's Algorithm in that, on line 12, the label is replaced if the "longer" path has the same weight (this is slightly redundant, but affects the answer to this question). Once the Algorithm is completed, the graph should look as shown. The label on Vertex D states previous=E and distance=8.



28. B Create a graph connecting chemicals which *cannot* travel together. Then, color the graph to determine which chemicals *can* travel together. Such a graph is shown, and shows that three boxes are required.



29. C Rather than actually performing Gauss-Jordan Elimination on each matrix, note that the resultant matrix implies that $\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} -4 \\ 1 \\ -2 \end{bmatrix}$. Multiplying each "left side" by this answer matrix results in each "right side," except for choice C. In fact, choice C should read $\left[\begin{array}{ccc:c} -2 & -3 & 4 & -3 \\ 0 & 8 & 4 & 0 \\ 3 & 2 & -5 & 0 \end{array}\right]$.

30. D The probability of the chip starting in each of the four slots on top is 1/4. For the first and fourth slot, the chip can only fall one direction. For the second and third slots, the probability halves for the chip falling either left or right. For the second set of pegs, the probabilities of the three "slots" are 3/8, 1/4, 3/8. For the third set of pegs, probabilities are 3/16, 5/16, 5/16, 3/16. For the fourth set of pegs, probabilities are 11/32, 5/16, 11/32. For the fifth set of pegs, probabilities are 11/64, 21/64, 21/64, 11/64. Finally, the probabilities for each receptacle are 43/128, 21/64, 43/128. Hence, the probability for the center receptacle is 21/64, answer D. This Plinko board is similar to the quincunx machine.