

Tutorial 3 - Functions and Relations

20th January 2017

1. Six cars, each of different colors **I**, **B**, **G**, **Y**, **O**, **R** are to race. In how many ways can they hit the finish line.?
2. You obviously assumed that no two cars can end up in a tie. What if we were to consider the case where ties are possible? The answer isn't obvious! We will solve this question by the end of this tutorial.
3. Define a binary relation from A to B .
4. What are the total number of relations from A to B , assuming these sets to be finite?
5. What are the total number of relations on a given finite set S ?
6. Show that every function is a relation, but not conversely.
7. What are the total number of functions $f : A \rightarrow B$, given that A and B are finite sets?
8. What are the total number of 1-1 functions from A to B ?
9. What are the total number of onto functions from A to B , given that $|A| = 3$ and $|B| = 2$?
10. Answer the above question with $|A| = 4$ and $|B| = 3$.
11. Do you observe a pattern from the previous two questions? What is the answer in general, for $|A| = m$ and $|B| = n$?
12. What is the total number of ways you can put m distinct balls into n identical containers?
13. Show that $S(m + 1, n) = S(m, n - 1) + nS(m, n)$.
14. Use the above formula to find $S(6, 4)$.
15. Can you now answer the first question?
16. In how many ways can we factor 30030?
17. Observe that the answer for the first question and the previous question is the same. Why?