3) The local diner offers a meal combination consisting of an appetizer, a soup, a main course, and a dessert. There are four appetizers, two soups, four main courses, and four desserts. Your diet restricts you to choosing between a dessert and an appetizer. (You cannot have both.) Given this restriction, how many three-course meals are possible?

Solution: If you have an appetizer, soup and main there are 4x2x4 = 32 possible three-course meals. If you have soup, main, and dessert there are 2x4x4 = 32 possible three-course meals. You have a choice (alternative) so we add the results to get 32 + 32 = 64 possible three-course meals under this restriction.

4) A test has 12true-false questions, then a choice of either completing 6 multiple choice questions with 1 correct answer out of 4, or completing 5 multiple choice questions with 1 correct answer out of 3. How many different completed answer sheets are there?

Solution: Twelve true-false questions gives $2^{12} = 4096$ possible answers for that part. Multiple choice questions gives $4^6 = 4096$ because you have four options and six total questions. The other multiple choice gives $3^5 = 243$ possible answers. But how do we put these together? T/F AND THEN MC OR MC:

$$2^{12}(4^6 + 3^5) = 4096(4096 + 243) = 4096(4339) = 17{,}772{,}544$$

possible ways to complete an answer sheet.

5) Professor Easy's final examination has 9 true-false questions followed by 3 multiple-choice questions. In each of the multiple-choice questions, you must select the correct answer from a list of six. How many answer sheets are possible?

Solution: TF followed by MC is multiplication principle:

$$2^9 x 6^3 = 512 x 216 = 110{,}592$$