PROBLEM 4001: A large nation, of whom we will only concern ourselves with adult males, N in number, and who each bear separate surnames colonise a district. Their law of population is such that, in each generation, $a_0$ per cent of the adult males have no male children who reach adult life; $a_1$ have one such male child; $a_2$ have two; and so on up to $a_5$ who have five. Find (1) what proportion of their surnames will have become extinct after $r$ generations; and (2) how many instances there will be of the surname being held by $m$ persons.