Five Robbers

Five robbers meet to share out 100 gold coins they have stolen. Their process for determining the share each robber gets is as follows: They draw numbers 1 through 5. Robber No. 1 proposes a sharing scheme and all of the robbers vote whether or not to accept it. If the proposal is accepted by an absolute majority (i.e., > 50%) of those voting, the coins are shared accordingly. If not, the robber proposing the scheme is booted out of the gang and Robber No. 2 proposes a different scheme. This process continues until a scheme is accepted. Each robber is completely rational and acts totally in self-interest. How will the coins be shared among the five robbers? (Assume that each coin remains whole.)

Solution to Five Robbers

Consider the situation when only two robbers (Nos. 4 and 5) remain in the gang. Regardless of what Robber No. 4 proposes, Robber No. 5 will vote against it, boot Robber No. 4 out of the gang, and claim all 100 gold coins. The distribution of gold coins among the five robbers would be (0, 0, 0, 0, 100).

Now consider the situation when only three robbers remain. Robber No. 3 needs the vote of only one of the other two. He proposes to give Robber No. 4 one gold coin and to keep 99 for himself, leaving none for Robber No. 5. Robber No. 4 votes in favor because he knows that if he does not, he will wind up with nothing and he prefers one coin to none. The distribution would be (0, 0, 99, 1, 0).

Next consider the situation when four robbers remain in the gang. Robber No. 2 needs a total of three votes – his own and two others. So he proposes to give two coins to Robber No. 4, one coin to Robber No. 5, and 97 coins to himself, leaving none for Robber No. 3. Both Robbers Nos. 4 and 5 vote in favor. The distribution would be (0, 97, 0, 2, 1).

Finally, consider the starting situation with all five robbers in the gang. Robber No. 1 needs the votes of just two other robbers. He knows that he can get these by offering one coin to Robber No. 3 and two coins to Robber No. 5, keeping 97 for himself and leaving none for Robbers Nos. 2 and 4. So the final distribution of gold coins among the five robbers is (97, 0, 1, 0, 2).