
UNIT 7 THEORY OF SOCIAL CHOICE

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7.0 OBJECTIVES

After reading this unit, you will be able to:

- present an account of the evolution and essence of 'social choice theory';
- discuss the rationale behind the concepts of 'individual decision making' and 'collective decision making';
- distinguish between individual values and social choice;
- state Arrow's Impossibility Theorem along with its conditions;
- illustrate the element of 'impossibility' in Arrow's theorem;
- show that for some profiles of individual preferences, majority rule may not yield consistent social choices;
- exemplify the concepts of 'Condorcet winner' and 'Condorcet loser';
- explain the different types of 'voting systems'; and
- outline the concept of 'strategic voting'.

7.1 INTRODUCTION

At the heart of the social choice theory lies the analysis of preference aggregation. It refers to the aggregation of several individuals' preference rankings (of two or more social alternatives) into a single, collective preference ranking. Inputs are often illustrated as sets of individual votes (e.g. judgements, opinions, interests, welfares, well-being) whereas output is considered as the social set of collective

decisions. Both individual inputs and social outcome have preference order of alternatives i.e. they admit indifference between alternatives.

Aggregation function is the rule (or process or procedure) whereby inputs of individual preferences are converted into outcome of social preference. There can be a variety of rules to carry out this role. Each rule is based on certain implicit or explicit axiom(s) and may yield a different outcome from the same set of individual preferences. Arrow, an economist, preferred to call these procedures as Social Welfare Functions as he tried to extend the boundary of Social Welfare Function (proposed by his predecessor Abraham Bergson) through certain modifications. Arrow held that methods of collective decision making (social choice) could be classified as custom or authority or consensus. He suggested voting for aggregation whereby a decision on consensus could be arrived at. Study of such procedures (for arriving at decisions) with respect to consistency with certain desirable axioms is what 'social choice theory' is about. Social choice theory is thus not a single theory but a set of models attempting to translate individual preferences into collective preferences.

For a society, collective decisions are often needed in many affairs. Various procedures have been evolved for this in which individual capabilities and endowments on the one hand, and power equations between them on the other, have played roles. Different societies have formed different procedures for same issues and across issues. Further, rules do not remain static. This is partly owing to inter-society interaction and partly to internal dynamics and evolution of intellectual development. That is how societies ranging from autocratic to democratic have come into existence. Within a democracy, different procedures are used for collective decisions in different realms and in different regions.

Though rules have been evolving over a historically long time, systematic study of the procedures is not very old. Such studies were very few until the late twentieth century. Two French scholars [viz. physicist Jean Charles de Borda (1781) and mathematician Nicolas de Condorcet (1785)] initiated the formal discipline of social choice (around the time of French Revolution). They did this in the area of voting and related procedures. Charles L Dodgson and Thomas Hare were prominent in this respect in the 19th century. In the later half of the 20th century, modern social choice theory was initiated by Kenneth Arrow. He enmeshed social ethics and voting theory with a touch of economic flavour. The area engaged other brilliant minds like Duncan Black and Amartya Sen later.

Voting mechanisms are simpler affairs but essentially pose the same issues as social choice. Candidates actions, and policies (rather than full spectrum of social states) are the alternatives to which individuals in the groups vote for i.e. they order their preferences. Though the refrain of literature is about full societal domain, it is applicable in clubs, company boards, or cooperatives as well.

7.2 INDIVIDUAL AND COLLECTIVE DECISION MAKING

Individual choice, or popularly consumer choice, is about choosing a bundle of commodities under a budget constraint. Possession of the bundle of commodities with positive economic value (prices), subject to consumer's income or budget, requires the choice of 'any one of possible bundle of commodities'. In this, the decision of the consumer reflects his most preferred choice. As Arrow articulated in his Nobel Prize Lecture, consumer compares two bundles at a time and prefers

one. The preferred one is then again compared with a third bundle and then again one of them is preferred & so on. Thus, in general, if there are N bundles, there may be $N(N-1)/2$ pairs to compare and choose from. Let there be three bundles x , y , and z with three pairs (x, y) , (y, z) and (x, z) to decide from. If x is preferred over y and y over z , then consistency demands that x be preferred over z . Such relations are known as binary relations and the property (of relating x with z as done above) known as 'transitivity'. If z is the bundle in consumer's possession, he may exchange z for x [or he could retain z or go over to y or x]. However, such an exchange or choice requires that all three must have same exchange value. The framework therefore admits *indifference* between the two members of a pair.

It is important to note that by assumption all commodity bundles have the same value and that the aggregate value of the bundles is the sum of the values of each bundle (where the value of one bundle is the sum of the values of each commodity in the bundle or simply the multiplication of price and quantity of a commodity in each bundle). However, if price of one commodity were to change, it would change the residual income available for other commodities too. Thus, demands for all commodities are interdependent (i.e. some more, some less). Demand for a commodity can thus be seen as a function of all prices and all commodities brought together makes it a case of general equilibrium. Note that one can determine only $(n-1)$ price ratios for any 'n' commodities in a bundle. Absence of a commodity in a bundle would be regarded as 'zero' quantity.

Individual choice discussed above presumes existence of market and thereby presence of prices. Preference for commodities (and therefore for bundles of commodities) is subjective to the individual while prices are objective i.e. the same for everybody (except for public goods). While choice for individuals may also be made by others (say by parents for small children, for education and sports, and marriage in certain societies, by doctors in treatment, and by others in case of merit and de-merit goods), the dominant mode of economic analysis has been individual choice by individuals based on their preference orderings in a market environment. This implies that individual makes the decision for himself. Collective decision making for social choice is an important area of analysis in social choice theory where religious traditions, societal conventions, dictators (benevolent or not), etc. have also contributed to the modes of social choice. Choice for society with consideration of preferences of individual members of the society is referred to as 'collective decision making'.

Collective decision making is different as market is not the arbiter here. There are many situations where mechanisms other than market are called for. Some of them can be illustrated in terms of market failure and government intervention. But there are situations such as achieving just distribution of resources where market is a poor guide. A choice as to who will represent them in a body like legislature is a social choice. If based on individual social preferences, choice is made through collective decision-making. Choice might differ, depending on persuasions across societies. For instance, whether a village should have a sunk well or a dug well, a technical school or a vocational school, an allopathic dispensary or an ayurvedic dispensary when only one of them is achievable, etc. falls under collective decision making or choice. One can create several combinations of well, school, and dispensary (in fact, $2 \times 2 \times 2 = 8$) with extreme alternatives of none and all. With each society having a preference order of these 8 social alternatives, majority voting rule becomes one of the collective decision making rules.

Social choice by a single person, say dictator, may have consistency called transitivity. Here, only one person collects all conceivable social state and orders them according to his social preference. The other case which has consistency is when each individual has the same preference ordering where social preference will coincide with individual preference. This is also the case of unanimity. When individuals' social preferences are different and have to be amalgamated/aggregated as in a democracy, there is no guarantee of transitivity of preference. This means, a unique complete social ordering may not emerge.

7.2.1 Individual Values and Social Choice

Consider a set of all possible social (alternative) states of a society. Assume that each individual member of the society has a preference ordering over all social states. Each social state contains each individual's lot in terms of his enjoyments and obligations. An individual's preference ordering is not concerned with his lot alone in each social state but of others' as well [because of his social attitude (hierarchical or egalitarian), his ideals on justice in distribution (socialist, liberal, or capitalist), and his views on distribution of benefits from collective action (local community or government)].

Dealing with individual choice based on personal preference under constraint is far easier as one is not dealing with (i) inter-personal comparison and (ii) one's social preference based on one's social values. Avoiding inter-personal comparison leads to defining an action as Pareto-improvement if at least one person feels better off while no one feels worse off. Pareto-optimum is therefore defined as *impossibility* or absence of Pareto-improvement. Dealing with aggregation of social values of individuals constituting the society is not easy. To cope with this, generally, we resort to majority voting rule to create a social ordering of states. However, it is possible that no unique solution is discovered.

Check Your Progress 1 [answer within the given space in about 50-100 words]

- 1) Illustrate individual decision-making in economic domain.

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- 2) State how individual decision-making is a case of general equilibrium.

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- 3) Distinguish between collective decision making and individual decision making.

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- 4) State the basis on which an individual ranks various social states.

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7.3 SOCIAL STATES AND INDIVIDUAL ORDERING

The word social state has a very specific connotation in welfare economics and social choice theory. As stated by Kenneth J Arrow, a social state is ‘a complete description of the amount of each type of commodity in the hands of each individual, the amount of labour to be applied by each individual, the amount of each productive resource invested in each type of productive activity and the amounts of various types of collective activity (such as municipal services, diplomacy and its continuation by other means). There could therefore be a good number of social states. Each individual of the society is assumed to have a definite ordering of all conceivable social states in terms of desirability to him.

Different individuals, depending upon their status (rich or poor) or disposition (class-based or egalitarian), will have different orderings of the conceivable social states. In contrast to theory of consumer choice, where individual’s tastes play a significant role, in social choice theory individual’s (social) values are crucial. Values may include values about values! Market mechanism takes into consideration only tastes whereas social choice theory considers value-based ordering of social states by individuals.

To write it more formally, let the set of social states be x, y, z, w, \dots . For any pair of social states, the ordering relationship R could have either strong preference P or weak preference (indifference) I . For individual i , for a pair of social states x and y , the relationship xR_iy could be one of the three: xP_iy , yP_ix , and xI_iy . Combining P with I , one can write xS_iy or yS_ix where S is a relationship either one of preference (P) or indifference (I). For ease of understanding, if preference P be taken as ‘greater than’ and indifference I as ‘equal to’, then S would stand for ‘greater than or equal to’. Arrow calls this as ‘property of a binary relation’ (Axiom 1). It is assumed that individuals would be able to express full order of preference, taking two at a time, including indifference. Note that if xP_iy (read: x is preferred over y) and yP_iz , then xP_iz . This property, called Axiom 2, is known as the property of *transitivity*. Note that while P is strong ordering, S is weak ordering. For the society, the letters R, P, I and S are without subscript. The three

relationships between x and y would be stated as xPy , yPx , and xIy . Combining P with I , one can alternatively write xSy or ySx . The whole approach is ordinal i.e. one prefers a bundle over another and not by not 'by how much' (which would make it cardinal).

7.3.1 Arrow's Impossibility Theorem

Arrow's impossibility theorem (or general possibility theorem as Arrow calls it) states that, while adhering to mandatory principles of fair voting procedures (where a society has at least two individuals and at least three options), it is impossible to have a clear social order of preferences from the individual orders of preferences of social states.

Like Hicks, Arrow accepts the ordinal utility principle and rejects inter-personal comparison of social states (as Pareto does). Arrow seeks to find a democratic rule whereby social order of preference can be created from individual orders of preferences with the rule adhering to certain plausible conditions (called axioms by Arrow). Arrow finds that aggregation procedure of individual order of preferences for social states can fail to yield a socially ranked order of alternative states when aggregation principle should pass certain criteria. Relationship requires to make a pair-wise comparison between options as this automatically ensures each time the majority rule. The criteria, called conditions, were stated by Arrow in his book *Social Choice and Individual Values* (1951). The axioms, numbered 5, is modified and clubbed in modern treatment, and are stated as the following three conditions.

Unanimity or Weak Pareto Efficiency: If alternative x is strictly preferred over y for all individual orderings R_1, R_2, \dots, R_n , then x is preferred over y in social ordering [which is simply an aggregation rule $R = F(R_1, \dots, R_n)$]. Thus, unanimity implies non-imposition. For illustration, we can take x and y as candidates in an election and aggregation F as majority voting rule.

Non-Dictatorship: There is no individual, i , whose strict preference always prevail. This is to say that there is no individual i in the society such that for all (R_1, \dots, R_n) , x preferred over y by R_i [implying that x is preferred by aggregation rule $R = F(R_1, R_2, \dots, R_n)$, for all x and y].

Independence of Irrelevant Alternatives: For two preference profiles (R_1, \dots, R_n) and (R'_1, \dots, R'_n) such that for all individuals i , alternatives x and y have the same order in R_i as in R'_i and alternatives x and y have the same order in aggregation rule $R = F(R_1, R_2, \dots, R_n)$ as in $S = F(R'_1, R'_2, \dots, R'_n)$.

What Arrow implies is that if there are three or more alternatives, all rules can fail to adhere the plausible principles. In other words, counter-intuitive result is given too much attention, making the majority rule to always fail. It does not mean that the rules always fail but only that they can fail under certain circumstances. We can illustrate the impossibility by some simple exercises as follows.

Case 1: Two Individuals and Two Social States

Let us start with two individuals A and B and two social states x and y . If both prefer x over y , then, for society too, x is preferred over y (i.e. xPy). If the individual orders are reversed, the social outcome is also reversed. However, if the two individuals have different preference orders i.e. xP_Ay while yP_Bx , then there is no unanimity (and no majority) and it can be interpreted as social indifference i.e. xIy , which does not exist in individual orderings. It is equivalent to saying xI_Ay

and xI_by which is not the case. We do not know how strongly x is preferred over y by individual A (or y over x by individual B) as it is disallowed by ordinal preferences. Interpersonal comparison is also not allowed by Pareto principle.

Case 2: Two Individuals and Three Social States

Let both A and B prefer x over y and y over z . Then, social choice by collective decision is the same i.e. x is preferred over y and y is preferred over z . If the individual orders are reversed, the social outcome is also reversed. However, if the two individuals have different preference orders i.e. xP_ay and yP_az while zP_bx and xP_by then by transitivity, xP_az and zP_by . There is no unanimity and no majority. Both prefer x over y (i.e. xPy) but while A prefers y over z , B prefers z over y . This can be interpreted as social indifference yI_z . Likewise, as A prefers x over z while B prefers z over x , we have xI_z . Likewise, from yI_z and xI_z , we have xI_y . But we have also seen xPy . But x cannot be both socially preferred over and socially indifferent with y . Hence, the impossibility.

Case 3: Three Individuals and Three Social States

Let there be three individuals A , B and C and let all of them prefer x over y and y over z . Social choice by collective decision is the same i.e. x is preferred over y and y is preferred over z . If the individual orders are reversed, the social outcome is also reversed. However, if all three have different preference orderings over x , y and z , then there would be problem i.e. majority rule may not yield proper social order over x , y and z . For instance, let us choose the particular set of individual orderings as below.

Individual	Preference Orders	By Transitivity Implication	Collecting Individual Pair-wise Preferences	Majority Decision
A	xP_ay and yP_az	xP_az	xP_ay and xP_cy while yP_bx	xPy
B	yP_bz and zP_bx	yP_bx	yP_az and yP_bz while zP_cy	yPz
C	zP_cx and xP_cy	zP_cy	zP_cx and zP_bx while xP_az	zPx

If transitivity is employed to majority rule pairs i.e. xPy and yPz , one finds xPz which contradicts zPx . Thus, it is possible that for some profiles of individual preferences, majority rule may not yield consistent social choice. The result would be true for n persons and N states. For states, the logic can be extended for w , v , u , etc. For persons, it simply means $m(xPy) > n/2$. Note that impossibility theorem only says that a rule may not work for all profiles to yield a social choice (or a profile may not yield social choice by all rules) i.e. Arrows simply says no rule is foolproof if axioms have to be adhered to.

Several alternatives are suggested to relax Arrows's axioms. One of them is 'Median Voter Wins' Theorem for majority voting rule where the options are objectively ordered and voters have single-peaked preferences. Economists find justification for single-peaked preference as it is consistent with marginal benefits. But multi-peaked preferences cannot be ruled out in practice. Moreover, options may not be aligned on an axis in a unique way.

Check Your Progress 2 [answer within the given space in about 70-100 words]

- 1) What is meant by a 'binary relationship'? What is transitivity?

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- 2) State the axioms which the social preference ought to conform.

- 3) Under what conditions the majority rule criterion will work?

7.4 VOTING MECHANISMS

Individual opinions are combined to represent the majority will of the group/society in a certain matter, particularly representation in a legislature by the mechanism of voting. People may be asked to choose only one option (his best), or rank all options, or rank a limited number of options, or assign cardinal values to his options such that the total does not exceed a certain number, say 100. There are a variety of electoral systems and a variety of voting mechanism. A few essential voting mechanisms (not electoral systems), after dealing with the concept of voting first, are covered in this unit.

7.4.1 Concepts of Voting

Let there be 5 candidates A, B, C, D, and E and 31 voters whose votes are also found valid. Voters are asked to rank them in order of preference with the last preference taken as rejection. Let us suppose there are four different profiles (distinct preference orders) i.e. individuals fall into four groups and members in each group share the same profile. In the Table below, the number of voters are indicated in the first row who add up to 31.

Votes/ Rank	5	9	10	7
1 st	A	A	B	D
2 nd	B	C	C	C
3 rd	C	B	D	B
4 th	D	D	E	E
5 th	E	E	A	A

Single Vote: First Past the Post Voting: On the face of it, A seems to be the winner. He is indeed the winner if the criterion is $V_k > V_i \ I \neq k$ i.e. candidate k has more votes than anybody else if voters were asked to give a single vote. He gets 14 votes whereas B gets 10 and D gets 7 only while C and E get none.

Preference Voting: Looking at preference pattern, A gets 14 first preferences (affirmative votes) which is less than the half while he scores 17 last preferences, which is actually more than the half. If voters were asked to reject the candidates, A would have been the first to be rejected. C and E do not receive first preference at all. So if we strike off C and E and prepare the Table afresh, we get the following scenario.

Voters/ Rank	5	9	10	7
1 st	A	A	B	D
2 nd	B	B	D	B
3 rd	D	D	A	A

There is a good argument for electing B as: (i) none has clearly scored more than half of votes, and (ii) B scores 10 first preferences (in comparison to A 's 14 and D 's 7) and 21 second preferences (while A scores no second preferences and D only 10). But there should be a rule for electing B .

One could well argue in favour of electing C since in the original Table, in pair-wise comparison, C is held better than others by 26 voters at second place. But in pair-wise comparison, out of 31, C is preferred by 17 over A , by 16 over B , by 24 over D and by all 31 over E . Thus, if there were election between C and A , C and B , C and D and C and E , each time C would be winner. Thus, C is said to be Condorcet Winner. Again, in pair-wise comparison of A with B , C , D , and E , 17 do not prefer A . A is, therefore, Condorcet loser.

7.4.2 Types of Voting Systems

It is clear from 7.4.1 above that different voting rules may produce different outcomes and therefore setting rules is very important. With this background, let us now consider some of the voting rules or mechanisms.

Plurality System (or First Past the Post System): Suppose, voters are asked to vote for only one candidate and the candidate who receives the highest number of votes is declared elected (irrespective of whether or not the winning candidate receives 50 percent or more votes). If there are more than two candidates, there is every likelihood that the highest scorer may not get 50 percent votes. This system is known as plurality voting mechanism as the winner receives the most plural (numerous) votes (and also is First Past the Post as he is the first among those who cross the post of V/n , where V and n respectively denote the total number of valid votes and the number of candidates). Mathematically, votes of k^{th} candidate $V_k > V_i, i=1,2,\dots,n$ and $i \neq k$ and $V_k > V/n$. In most countries and in most political elections, this system is followed. The UK, the USA, Canada and India are among around 50 countries, with over 200 crore people, where in most elections this mechanism is applied. Around more than a dozen countries in last few decades, however, have decided to discard it in favour of other systems. In this system, the vote percentage cast for a party often diverge a great deal from the seats won. In India too, the political debate centres around this issue. The system is notable not

only for its simplicity and its impact on political process but also for the ease of manipulation as well as its theoretical weakness. It is argued that this voting method promotes two party system or two major coalitions. In India, parties tend to form few regional and national coalitions though parties tend to be in thousands. However, if the constituency is a multi-member one, each voter is allowed to vote for as many candidates as are the positions (say, s). Votes for each candidate are counted and the first s candidates are declared elected. This is often called as the *Block Vote System*. In many small countries, this system is in function. The system tends to favour candidates rather than their affiliations.

Majority Voting: Plurality is here replaced with majority where majority is interpreted as minimum 50 percent. If $n > 2$, the plural candidate may not score votes more than 50 percent. Then, polling for top two scorers is again carried out so that one obtains minimum 50 percent votes in the second round. The system is also known as Two-Round System or Run-Off System. Another variation of this is where the voters vote by preference. This is known as Instant Run-Off System or Alternative Voting and is discussed further below.

According to Kenneth May (1952), simple majority voting is the only anonymous, neutral and positively responsive social choice system between two alternatives. However, it applies when there are an odd number of voters and ties are not allowed. In certain cases, supermajority rule is followed where three-fifth (60 percent) or two-thirds (66.7 percent) or three-fourth (75 percent) is imposed as the post. Some referendums in European countries fell through where options were 'yes' and 'no' as votes for 'yes' crossed 50 percent mark but not the stipulated 60 percent. Some very important issues, like Brexit, passed as the stipulation was simple majority.

Alternative Voting System: In this system, voters are asked to rank candidates in order of their preference. If someone passes 50 percent mark, he is elected. If no one secures more than 50 percent, the candidate with the minimum number of votes is rejected and second preference of his voters is counted for the remaining candidates. The process is repeated until someone secures more than 50 percent votes. Australia is a major country (among 20 countries with bare 2.5 crore people) where Alternative Voting Mechanism is employed. This is similar to the electoral system used in Presidential election in India. In multi-member constituencies, the votes of the candidate with least votes are transferred to other candidates and the process is repeated until the number of candidates left are equal to the number of positions. Called as Block Vote and used in 15 countries with 3.0 crore people, this method is also used in Rajya Sabha elections in India.

Borda Counting Voting System: Voters are asked to give their preference to each candidate in the fray. With a view to give weight to voters' other preferences and thus develop some kind of consensus, de Borda suggested that the ordinal numbers 1st, 2nd, 3rd, etc. could be read as integers. Scholars have called this as cardinalisation of ordinal preferences. Under this method, if there are n candidates, 1st preference should be given weight of n , 2nd preference weight of $n-1$, and so on. Thus, the candidate with last preference has weight of 1. Thus, vote value is calculated rather than votes are counted. This mechanism of aggregation (known as Borda Counting System) have many variants. One is the least preferred candidate is given weight zero, next to him weight 1, etc. It is thus moved up where the most preferred gets $(n-1)$ weight. In another variant, weight for i -th preference is the inverse of i i.e. $(1/i)$. Thus, 1st preferred gets weight 1, 2nd gets weight $1/2$, 3rd gets $1/3$, etc. Thus, n th gets weight $1/n$. This is known as Dowdall system.

Point Voting: In this method, across each candidate, say, 0 to 9 encircled marks are printed on the ballot and voters are asked to rank each of the five between 0 (worst) and 9 (best) [not necessarily different]. Thus, voters show some strength of preference as well. Also known as Score Voting, the procedure sums the scores obtained by a candidate in different ballots. The candidates who score the highest is declared winner. A preference order of candidates may also be prepared and in multi-member constituency, required number may be chosen. In a variation, a voter may be given 100 points which he can distribute among the candidates as per his choice. These points may then be summed up for each candidate with the rest of the procedure remaining the same.

7.4.3 Strategic Voting

Rather than revealing one's true order of preference for candidates, if one chooses to vote keeping in mind the consequence in the election or in the next stage, the voting mechanism is called strategic.

If a candidate of one's choice is not likely to win, one may then choose to vote for the candidate who is most likely to win so that his win is assured or vote does not go waste. Even if the best candidate wins, he may not be a part of winning coalition. One may also choose to vote for the candidate who is most likely to defeat a candidate of his disliking rather than vote for one who he really prefers. While first one is known as 'compromising', the second one is known as 'burying'. If there is going to be a second round voting which again goes in favour of one in the first round, the one who would be eliminated in the second round is called 'mischief voting'. This is an example of the case of plurality voting in single-member constituencies. In a multi-member constituency, if one votes only for one candidate, one is carrying out strategic voting but with sincerity. Further, in small constituencies, there may be logrolling where two voters may trade votes (i.e. you favour my candidate and I favour yours). This is also done in case of issues.

In proportional representation by party-list, if the system has a threshold, a voter might choose to vote for a party which can just make it to reach the threshold rather than vote for a party which in any case is going to make a big win. However, every voter does not resort to tactical voting all the time. It has therefore been argued that voters revert to their normal preference voting even if they had strategically voted in a particular election.

Check Your Progress 3 [answer within the given space in about 50-100 words]

- 1) Differentiate between plural voting and majority voting?

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- 2) State the Borda Count Method.

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- 3) What is 'Strategic Voting'?

7.5 LET US SUM UP

This unit introduces the issues of social choice where decision-making is based on individual preference orders about social states and the procedure is not dictatorial. When society is considered as a whole, individuals are supposed to be concerned not with their lot in each situation but also that of others. This means they are guided by their social values and attitudes. This principle was followed by Kenneth Arrow to improve the Social Welfare Functions devised till then. For this, Arrow incorporated voting theory within the domain of Economics. Arrow found that no method is foolproof to ensure certain plausible democratic axioms. The unit has also discussed the different types of voting which is essentially involved in collective decision-making for social choice.

7.6 KEY WORDS

- Collective Decision-Making** : Democratic process of aggregating individual preferences into a social choice.
- Ordinal Preferences** : Sequence of preference over social state of affairs (including candidate in an election) where strength of preference is not involved.
- Social Choice** : Social or collective choice based on individual preference orders of social states and their (social) values.
- Social State** : Complete description of entitlements and obligations of each of the members of a society.
- Voting Paradox** : Cyclical behaviour of pair-wise voting.

7.7 SOME USEFUL BOOKS

- 1) Amartya Sen (2017). *Collective Choice and Social Welfare: An Expanded Version*, Harvard University Press.
- 2) Allan Feldman and Roberto Serrano (2016). *Welfare Economics and Social Choice Theory*, Springer Science.
- 3) Wulf Gaertner (2009). *A Primer in Social Choice Theory: Revised Edition*, Oxford University Press.

7.8 ANSWERS OR HINTS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress 1

- 1) Economic domain in contrast to political and social or cultural domains relates to market. Consumer choice is an illustration.
- 2) When price of a commodity changes, income available to be spent on the rest of commodities changes and therefore their quantities will also change. Thus, all commodities are interdependent. This interdependence makes it the case of general equilibrium.
- 3) One's preference order of social alternatives, involving one's values and persuasion, is individual decision making. An aggregation of such individual decision making into a social order of preferences of alternatives is collective decision making.
- 4) One's enjoyment of consumption bundles including leisure, obligations including putting in labour, attitude, philosophy, views and values.

Check Your Progress 2

- 1) A relationship between elements of two sets is a binary relation. If the relationship between x and y and that between y and z are the same and the same is found between x and z , it is said to be transitive.
- 2) Axioms of unanimity, non-dictatorship and independence of irrelevant alternatives.
- 3) If people have single-peaked preferences, majority rule criterion will work. However, options should be such as they can be put on a line.

Check Your Progress 3

- 1) In plural voting, the highest vote gatherer is not insisted upon to get more than 50 percent mark (which is the case in majority voting).
- 2) Ordinal preferences are given cardinal number with the candidate least preferred awarded weight 1 (or zero) and the candidate with first preference given weight of n [or $(n - 1)$].
- 3) Not voting for the candidate who is the best in one's estimate.