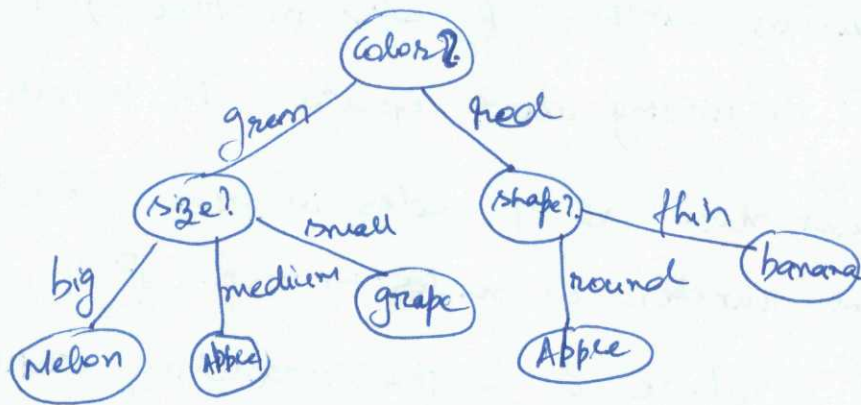
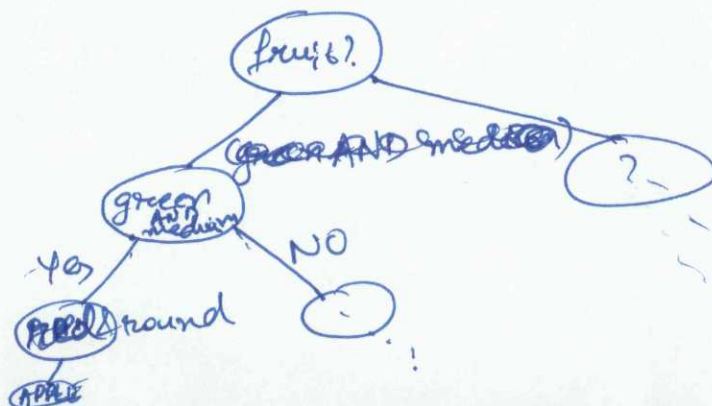


Q-3 (a) Any arbitrary tree with unequal branching ratios, can be converted into a functionally equivalent binary tree which produces same classification as original tree. This is possible because each of the classification / categories of tree can be represented using conjunctions & disjunctions i.e. in the form of equations with AND, OR & each OR can be one of the nodes of a binary split. e.g. taking a sample tree below which has



In this tree, we can represent classification of Apples (green AND medium) OR (red AND round) & similarly other branches/categories can be reduced in this form. The new tree is partially shown below:-



Q=3) (b) A tree with  $B \geq 2$  will have below lower & upper limits in a functionally equivalent binary tree

Lower limit :-  $\log_2 B$

upper limit :-  $B$

where  $B$  is the branching ratio

(c) From the properties of a binary tree, i.e. if a binary tree has height =  $h$ .

minimum number of nodes in tree =  $h$ .

& maximum number of nodes in tree =  $2^h - 1$

therefore; rewriting above equations in terms of  $B$ .

minimum number of nodes in tree =  $\log_2 B$

maximum number of nodes in tree =  $B^h - 1$

where  $B$  is the branching ratio