Q 2 (a) Brief summary of the paper :-

The research paper by McCullagh (1980) titled "Regression Models for Ordinal Data" discusses the statistical analysis of ordinal data, where the response variable has ordered categories. In this study, models for assessing the data are introduced & investigated, with a special emphasis on the proportional odds model.

The research underlines the significance of selecting an appropriate dependent variable for ordinal data analysis, which might represent a biological process or be used as a classification tool.

It makes a distinction between multivariate and univariate problems involving examining the relationship between the values of one variable and those of other variables.

The paper discusses the analysis of residual in the context of multinomial response models and introduces the use of residuals based on the contribution of the likelihood ratio statistic.

An example with taste testing data is provided to illustrate the analysis of residuals and the choice of an appropriate model. The analysis helps assess treatment concensus among judges

The paper shows how ordinal regression models, like the proportional odds model, are appropriate for analyzing ordinal data and producing relevant results based on the particular research problem.

Likelihood and Odds ratio in Ordinal Regression and Multi Class classification

In ordinal regression, the likelihood represents the probability of observing the given set of ordinal responses based on the model parameters. It accounts for the cumulative probabilities of falling into or below a particular category. The likelihood is computed for each category, considering the ordered nature of the responses. It involves cumulative probabilities and transition probabilities between adjacent categories.

The odds ratio in ordinal regression calculates the likelihood of falling into a certain category against falling into a higher category. It measures how often an observation is to fall into a specific group or one that is lower than another category. The odds ratio can be used to assess the impact of explonatory variables on the ordinal response's category placement.

The likelihood in regression problems represent the probabilty distribution of the continuous response variable given the explanatory variables. The focus is on the change in the expected value of the response variable for a unit change in the predictor variable.