# *COMPUTATIONAL ANALYSIS OF COMMODITY PRICES IN RURAL DEVELOPMENT (A CASE STUDY OF KATSINA AGRICULTURAL AND RURAL DEVELOPMENT AUTHORITY)*

*BY*


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# *APPROVAL PAGE*

*This project has been carefully read and approved by the following persons on the behalf of the Department of Mathematics and Computer studies, Federal University of Technology, Minna as meeting the requirement toward the award of Post Graduate Diploma in Computer science.*

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# *DEDICATION*

*This project is dedicated to my beloved father late Alhaji Salihu Makudawa, mother Hajiya Mama Salihu Makudawa, my wives and children only whom Allah can reward them for what they have done and encouraged me through all my academic pursuit.*

# *ACKNOWLEDGEMENT*

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*My acknowledgement also goes to all my classmate who contributed in one way or the other especially Mallam Shehu Yusuf Galadima Kontagora and finally those who wishes me well.*

# *ABSTRACT*

*The project work is on the computational analysis of commodity prices in Rural Development (a case study of Katsina Agricultural and Rural Development (KTARDA) using statistical tool (technique) for the comparison of more than two samples.*

*It is designed to improve and facilitate the comparison of prices of commodities produced so as to aid in a faster and more accurate planning for the future and also to aid the authority and government in its price polices.*

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## *CHAPTER ONE*

## *INTRODUCTION TO RURAL DEVELOPMENT PROGRAMME*

### *1.1 INTRODUCTION:*

*As trends in the quality of life in developing countries have recently become clearer, the growing significance of rural development has emerge. without sound rural improvement there can be no balance national economic development. Economic development requires the growth and modernization of both the rural and urban sectors. Indeed, in many developing countries, including Nigeria, such a large proportion of the total population is rural, that no national development can succeed without rural growth.*

*Rural and Urban sectors must form an integrated whole, they are essentially complementary. In a situation like Nigeria, Sustained urban development depends on agricultural expansion. No growth of our towns and cities can be satisfactory while the rest of the country is poverty-strickens depending preciously on the miserable returns of subsistence agriculture.*

*For a number of reasons, rural areas in most developing countries are at a disadvantage. Urban life becomes more attractive daily, particularly to the youths. Rural products command unfavourable terms of exchange. Traditionally, country dwellers are slow to accept, or even with for change; their aspiration are not high. In growing and dynamic economic like Nigeria's, these disadvantages are likely to continue unless special efforts are made for sound balance in our national development.*

*Rural development in the developing countries has tended to follow one of four patterns:*

*(i) Sector approaches, addressed either to a whole sector such as agriculture or to a few projects within it.*

*(ii) Coordinated approaches, addressed to the economic development of all sectors within a given area.*

*(iii) Participatory approaches, designed to involve the residents, first in selecting local economic and social goals, and then in pursuing them, with some government aid.*

*(iv) Multi-purpose programmes, aimed at stimulating economic growth, fostering popular support for government, and promoting security.*

### *1.2 THE CONCEPT OF RURAL DEVELOPMENT*

*Until recently,"Rural Development" and "Agricultural Output" were considered synonymous. but agriculture is by no means the only possible occupation for people living*

*in rural areas, and accordingly a new and broader view has emerge which distinguishes rural from merely agricultural development.*

*One important element in this view is increased opportunity. It equates rural development with changes in social and economic structures, institutions, relationships and processes. It concienes of rural development not as mere agricultural and economic growth alone, but as the creation and fair sharing of social and economic benefits resulting from this growth. In this view is implied a massive effort to increase production, create and spread employment, and root out fundamental causes of poverty, disease and ignorance. This view implies a modernization which would not only increase the capacity but also change attitudes, replacing the sense of dependence on the natural environment by the desive and ability to manipulating it.*

*The ambit of rural development is therefore very wide indeed. It includes generation of new employment; more equitable access to arable land; equitable distribution of income, widespread improvement in health, nutrition, and housing, maintenance of law and order; creation of incentives and opportunities for saving, credit and investment. It also involve creating wider opportunities for individuals to realize their full potential through education and sharing in the decisions and actions which effects their lives. It is not sectoral, but comprehensive. In a nutshell, rural development is the result of many interacting forces.*

## *1.3 NEED FOR CONCERTED EFFORTS IN RURAL DEVELOPMENT*

*In Nigeria, close to 80% of the people live directly or indirectly on the resources of land. At present, manpower in the rural areas is concentrated in agriculture. other occupations are lacking. It is important, therefore, to diversify the economy outside of the urban areas so that there will be employment openings for the excess manpower which is now engage in agricultural production. This step would lead to desirable geographical mobility. There is the danger that industrial development may turn out to be but a concentration of urban-based rural development would stimulate the growth of small-scale industries, which would in turn benefit fully from economic of sale and create localised markets in the rural sector.*

*Finally, there is a stong humanitarian reason for giving highest priority to rural development. Nigeria is now enjoying an increasing Gross National Product (GNO). The utility of an increasing national income is greatest if the increase is distributed among the*

*poorest strata of the population. The greater the population of GNP going to low income groups, the greater the effect of the increased GNP on the general welfare. This is an abstract statement: to make it concrete, consider how much more a family with an annual cash income of N12,000 will benefit by the addition of N1000 that will a family with an annual cash income of N80,000.*

*In the developing countries, opportunities are wanting to achieve a significant increase in per capital income. But to achieve this result policies and strategies must be adopted to improve the balance between urban and rural growth, between the development of agriculture and that of industry.*

## 1.4 PROBLEMS OF RURAL DEVELOPMENT IN NIGERIA

*The major problems of rural development in Nigeria can be discussed as follows:-*

### 1.3.1 AGRICULTURE AND AGRARIAN REFORMS

*i) Agriculture plays a vital role in the economy of Nigeria. It is growing and providing additional employment opportunities for growth, based on the existence of expanding markets, foreign and domestic, abundance of land and human resources as yet unused; availability of improved technology. But problems also exist. Alarge proportion of both export and food crops comes from holding so small that they produce only marginal returns. Incentives for production are low. Bottlenecks exist in transportation and distribution. Improved seeds, fertilizers, chemicals, credit and other necessities are in short supply.*

*ii) One present handicap is the traditional land tenure system which does not allow for individual ownership. Land is regarded as the joint property of the community. This puts many difficulties in the way of adopting new and improved practices, which are possible only in a system of individual. Banks have been unwilling to extend loans because they do not find satisfactory collateral such as the farmers are able to offer for security.*

### 1.4.2 RURAL MANPOWER AND UTILIZATION

*How are young people prepared to enter the labour market? In Nigerian public investment in formal education forms a substantial proportion of both national and State budgets. It should therefore be a matter for concern that the educational system has so far failed to produce the beneficial results needed in a predominantly rural economy. The nation*

*is full of 'school leavers'. The cities are rapidly filling up with young boys and girls who have gone through primary and secondary schools, obtained a diploma, learnt irrelevant subjects, and then found that no one want to hire them to put into practice what they have learnt. This is clearly a matter of concern since over 70 percent of the population live in rural areas.*

*For a successful rural development, we need a radical re-thinking of current attitudes to education and a basic revision of curriculum. We need a new curriculum which will provide for rural as well as for urban children, and will lead to the highest educational levels for all students capable of reaching them. This reconstruction will be a major task.*

### *1.4.3 RURAL LEADERSHIP*

*The success of a rural development programme does not depend on material resources alone. The human element is equally important. However desirable a given change, it will fail if it is arbitrarily imposed upon someone unwilling to accept it. A man ready for change only when he himself is convinced that he has a problem, and that he will have some share in solving it. Mature and able leadership in rural programmes is one of the best ways of bringing about this happy result.*

*The leader, known to and having influence with those whose life he wishes to improve, can indicate the direction of a proposed change, make clear its objectives and values, and involved those it affects in bringing it about. He can also pass on the wishes of the local people to high government officials. He can serve on programme planning or advisory committees or on task forces, and take part in voluntary organisations or service clubs. In all these activities, he will continually be creating wider and wider bases of support for the programmes.*

### *1.5.0 STRATEGIES FOR RURAL DEVELOPMENT*

*Many developing countries including Nigeria, have tried to solve the problems of rural poverty and neglects in a number of ways, such as those highlighted below:-*

### *1.5.1 COMMUNITY DEVELOPMENT*

*This term gained prominence during the colonial era when social welfare officers tried, by stimulating self help, to improve health, nutrition, and general community welfare. Its major objectives was social development and most of its activities were geared towards social problems, such as juvenile delinquencies. Later the objective changed from social to community development. Properly understood community development can have a vital role*

*to play. The term con notes that the people themselves exert their own efforts, joining with governmental authorities, to improve their economics, social, and cultural conditions.*

*The effectiveness of a community development programme will depend largely on the extent to which government encourages local planning and participation. Integration and coordination are other features essential for success in community development. This strategy is fundamentally educational, political and sociological. Its greatest value is that it is well suit for new programmes among people who need them. But to be successful it can not work alone. In carrying out these programmes, it must rely on expertise from other agencies, and at this level, up to now, its programmes have generally floundered and fallen viction to to various bureaucratic vivalries.*

### *1.5.2 AGRICULTURAL EXTENSION*

*An agricultural extension programme deals directly with the improvement of agriculture. Its prime objective is to help farmers increase production by persuading them to adopt improved technical practices, it develop skills, knowledge, and attitudes favourable to change in the farmers and their families. It enable them to benefit from research and technology, and its ultimate aim is to raise their efficiency and thus achieve a higher level of living. Demonstration plots and model forms are prequently used as teaching devices.*

### *1.5.3 INTEGRATED RURAL DEVELOPMENT*

*This is a recent strategy, but it is generally gaining ground in many countries, in contrast to former approaches. It is based on the premise that a combination of factors - not only the right technology and education, but also access to physical inputs and attractive markets is essential to get agriculture moving. The very concept of rural development demands an integrated, not an isolated or fragmentary application of knowledge and skills of all the relevant national services.*

*In other words, integrated rural development means a multi-purpose approval, as contrasted with the single purpose rural extension programmes. In this view programme of agriculture education and training, health and nutrition, rural electrification, cooperatives and the like must not be conceived in isolation.*

*Integrated rural development combines active participation of the people concerned with the establishment of an efficient institution and of administrative facilities supplying effective communication at all levels.*

## 1.6.0 SIGNIFICANCE OF THE STUDY

*The research aimed at helping the government and the citizen of Nigeria in improving the standard of living by finding ways to bring down the prices of agricultural commodities. The purpose of this project is:-*

*i) To improve the standard of living in Katsina State and the country at large, such that the government will be able to control the prices of the agricultural products. Though efforts being made to control prices by some of the previous governments have prove abortine due to lack of proper planning. Thus, it is the researchers hope that the outcome of this write-up will help the authority concerned to know the rate at which the prices has been varying year to year.*

*ii) The research will also enable the government to know the measure to take into considerations in order to bring down the prices of fertilizer and agro-chemicals, so that the prices of agricultural commodities will naturally come down by itself.*

## 1.7.0. AIMS AND OBJECTIVE

*The general belief is that Agricultural products are the most essential commodities in whenever one found himself. Therefore, it has a significant effect both on industries in terms of raw materials and community in term of food consumption.*

*i) One of the main aims is to analyse the prizes of certain agricultural commodities in Katsina State with particular reference to maize, mullet, guinea-corn, groundnut and rice.*

*ii) Moreover the aim is to determine the rate of variation in prices of some commodities within a given period on yearly basis.*

## 1.8.0 LIMITATIONS

*(i) This project is limited to Katsina State of Nigeria due to time and financial constraints. But the data used from 1992 to 1996 covered all the 34 local governments in the State.*

*(ii) Also the project is limited to the following commodities; maize, millet, guinea-corn, groundnut and rice among other varieties of commodities produced in the state with the hope that these will give a fair result that will enable appropriate action to be taken by the authority concerned despite its limited scope.*

*Besides, the result of this study could serve as an insider to future surveys on this or similar subjects.*

## CHAPTER TWO

## RURAL DEVELOPMENT PROJECTS AT KATSINA AGRICULTURAL AND RURAL DEVELOPMENT AUTHORITY

### 2.1 INTRODUCTION:-

The Katsina State Agricultural Development Project (KTARDA) was created in may, 1988 as a result of the bifurcation of the former Kaduna State Agricultural Development Project(KADP) being jointly founded by the World Bank, the Federal Government and the State government. In July, 1989, the Katsina State Farmers Supply Company was merge with the then Katsina State Agricultural Development (project to create Katsina State Agricultural and Rural Development Authority(KTARDA). The principal aim of the Authority is to increase food production and farm income of mostly small scale farmers who form the majority, with Katsina State Farmers Supply Company (FASCOKT) as its commercial wing which is responsible for sale and distribution of Agricultural inputs.

The World Bank loan was initially to end in December 1993 but due to some important uncompleted projects which needed completion, it was extended to December 1994 it left a mass of rural infrastructure, a considerable large number of trained personnel and numerous potential small scale farmers who could not hide their urge for more and regular flow of appropriate technical information production packages and other logistical support for a sustainable incremental food production and farm incomes. In order to achieve these and in live with the National Development goals, and objectives, the Katsina State Government recognized the need to sustain the tempo created by the demised projects and approved negotiation for two bridging loans, the National Agricultural Technology Support Project (NATSP) and National Fadoma Development Project (NFDP).

### 2.2.0 GENERAL OBJECTIVES

2.2.1 To increase food production of major rained and Fadoma Crops, farms incomes and living standards of mostly small scale farmers.

2.2.2 *The principal aim of the two loans is field based ie. the small scale farmers and his farm through a systematic improvement of the quality and effectiveness of research and extension services for the benefit of some 500,000 resource poor farmers. In order to achieve this objective the following areas will be interviewed among others:-*

*(a) Strengthening the technology development and flow system through the newly established Research Extension Farmers input linkage apparatus so as to increase farmers participation, quality of feedback to and from researchers and a higher adoption rate.*

*(b) Integrate non-crop subsector into the farming system e.g Livestock, Fisheries,Agro-Forestry, Soil Conservation and off-farm gender specific activities.*

*(c) Exploit and suppory the development of animal drawn implements and their use on post planting operation to allenate labour problem.*

*(d) Support the formation and grooving of farmers groups for both male and female farmers to facilitate input procurement, marketing of farm produce and rearing of small ruminants poultry rabbits and dry season farming for both male and female farmers.*

*(e) Privatise the seed multiplication progamme through selected out - growers.*

*(f) Promote use of improved, simple and low cost technologies.*

*(g) Privatise drilling activities (200 tube wells and 200 wash bores) and support other State and Federal institution on Fadoma Development in the State.*

*(h) Improve inigation management through water users assoation.*

*(i) Support the planning, monitaring and evaluation unit by raising its capacity to facilitate co-ordination of project work plans, Data Collection and Processing for monitaring progress of implementation and impact studies and evaluation.*

*(j) Support Human resources development department for staff in service training at all level.*

*(k) Support management and financial administration.*

2.2.0 ***ORGANISATIONAL STRUCTURE***

*The Katsina State Agriculture and Rural Development Authority has its Headquaters at Katsina andis composed of three zones as follows:-*

| ZONES | LOCAL GOVERNMENTS | HEADQUATERS |
|---|---|---|
| Zone I | Daura, Mashi, Mani, Katsina, Katsina, Kaita, Jibia, Rimi, Batagarawa, Bindawa, Zango, and Mai'adua. | Ajiwa |
| Zone II | Malumfashi, Kankara, Bakori, Funtua, Faskari, Kafur, and Danja. | Funtua |
| Zone III | Dutsinma, Safana, Batsari, Ingawa, Musawa, Kankia, Kurfu, and Matazu. | Dutsinma. |

*(The total area covered is 2.3 million Ha. or 23,662 Km square) At the headquaters, there are seven departments with identicals ones at the zonal level and these are as follows:-*

1. *Agricultural Services*
2. *Water Development*
3. *Planning, Monitaring and Evaluation*
4. *Human Resource Development*
5. *Engineering Services*
6. *Administration*
7. *Finance and Supply.*

2.3.0 ***MAIN ACTIVITIES OF THE DEPARTMENTS***

2.3.1 ***Agricultural Sevices Department*** *:*

*The activities of the agricultural services department include the following:-*

*(a) Strenghtening the technology development flow system.*

*(b) To streghthen the media unit to complement and supplement the effort of (FNT) through Radio and Television.*

*(c) To reactivate the mobile training unit.*

*(d) Setting up an agricultural projects liason committee to discuss issues of mutual cooperation, streamlive extension activities and minimise parallel operation.*

*(e) To integrate non-crop subsector into the farming system e.g livestock, fisheries, agro-forestry, soil conservation and off-farm gender specific activities.*

*(f) To exploit and support the development of animal drawn implements and their uses.*

*(g) To privatise and supervise the seed multification programme through selected out growers.*

*(h) To support formation of farmers group for both males and females farmers to facilitate into procirement, marketing of farm produce and rearing of small ruminant animals.*

(i) *To conduct research activities in Crops, Livesstock, Fisheries, Agro-Forestry, and farm mechanisation.*

### 2.3.2 WATER DEVELOPMENT DEPARTMENT

*The functions of the water development department includes:-*

(a) *Drilling if Tubewells and Washbores.*

(b) *Formation of Fadoma Users Association.*

(c) *Construction of go-downs i.e Shades, Stores, access roads etc.*

(d) *Construction of boreholes fitted with hand pumps, solar powered and windmills.*

(e) *Construction of Concrete open wells to be used directly by the rural people.*

(f) *Construction of earth dams for people and animals.*

### 2.3.3 PLANNIMG, MONITARING AND EVALUATION DEPARTMENT

*This department is rested with the following activities:-*

(a) *Preparation of annual work plans and budgets.*

(b) *Monitaring Projects Progress.*

(c) *Monitaring allocation and use of inputs.*

(d) *Conducts Special Studies on project activities.*

(e) *Carry out Core Surveys which include:-*

(i) *Village Listing Survey.*

(ii) *Large Scale reconnaissance Survey*

(iii) *Crop and Area yield Survey*

(iv) *Market Price Survey*

(v) *Rainfall data Collection*

(vi) *Dry Season Farming Survey*

### 2.3.4 ADMINISTRATION DEPARTMENT

*The administration department perform the following activities:-*

(a) *Establishment, grievances and disciplinary matters*

(b) *Secretariat Services to the Various Committee*

(c) *Security and Insurance to the Authority Properties*

(d) *Allocation and Control of Vehicles*

(e) *Co-ordination of Procurement and Supply of house/office equipments, stationaries/furnitures*

(f) *Maintainance of personal records*

(g) *Operation of staff clinic and welfare services*

(h) *Promotion industrial relation between the employee and the employer*

(i) *Liason with relevant bodies outside organisation*

(j) *Legal matters including various contractural obligations.*

2.35 ***FINANCE AND SULLY DEPARTMENT***

*The finance and supply department perform the following activities:-*

(a) *Preparation of budget and budgetary control, i.e to regulate the capital and recurrent expenditure*

(b) *Reconciliation of bank account and zonal current account*

(c) *Preparation and payment of monthly salaries and wages as well as bills and other charges*

(d) *Preparation of monthly, quartely and annual report including of monitoring of IBRD, FGN and KTSG finances*

(e) *Inssuance of good received Note and Store issue vourcher for any incoming goods and out going goods.*

(f) *Physical security of the store*

(g) *Diversified control of stock ordering and usage*

(h) *Careful decumentation of all stock movement and stock levels*

(i) *Sourcing of both local and foreign supplies of goods and contractors for works*

(j) *Preparing procurement plans, consultances service and Bid documennt for international and local tenders*

(k) *Placing international and local purchased orders, as well as job orders*

(l) *Liasing with othjer department in preparing technical preparation for contract both local and international*

(m) *Conduct market survey for both prices of goods and works to be carried out by the authority*

3.2.6 ***ENGINEERING SERVICES DEPARTMENT***

*This department is responsible for the following activities in the authority:*

(a) *Maintanance of feeder roads.*

(b) *Repairs and maintanance of all service vehicles and plant/equipment*

(c) *Renovation and rehabilitation of all buildings*

(d) *Formation of construction unit*

(e) *Fabrication and demostration of proto-type machines and implements*

(f) *Strenghtening linkage with agricultural services department in the field of farm mechnisation*

(g) *Development of animal drawn implements.*

2.3.7 ***HUMAN RESOURCES DEVELOPMENT DEPARTMENT***

*The Human resources development department is vested with the following activi ties.*

(a) *Organising and participation in appropriate training programme*

i. *Short-term Courses (in-house, off-project-in-country and overseas).*

ii. *Long term Courses*

iii. *Special training for extension staff*

iv. *Animal praction training*

v. *Succession training e.t.c*

(b) *Formulating man power development programme*

i. *Evaluation of training*

ii. *Youth development programme*

iii. *Production of animal training plan e.t.c*

(c) *Running and maintenance of training centres*

(d) *Training materials producion*

(e) *Strenghtening Headquarters training centres.*

2.4.0 ***GENERAL ACHIEVEMENTS***

*The general achievements of the authority includes:-*

2.4.1 ***CONSTRUCTION WORKS**:- The authority has constructed the following:-*

(a) *1 number Headquarter complex*

(b) *45 number Senior staff quarters*

(c) *105 number Intermediate staff quarters*

(d) *45 number Junior staff quarters*

(e) *1 number light vehicle workshop*

(f) *4 number multipurpose store*

(g) *5 number Rural feeder roads - 457.4 km*

(h) *5 number Rehabilitation roads - 102 km*

(i) *5 number Maintained roads - 187 km*

(j) *560 number Draining Culverts*

(k) *60 number soil conservation structures*

(l) *8 Earth dams*

(m) *215 open wells*

(n) *466 Boreholes*

(o) *1002 Tubewells*

(p) *1200 Washbores*

(q) *2 Animal traction training centres*

(r) *12 Fortnightly training centres*

(s) *1 Seed processing plant*

(t) *6 Fish culture ponds*

2.4.2 ***ESTABLISHMENTS***

*The authority has established the following:-*

(a) *3 Administrative Zones with management*

(b) *6 sub-zonal Area offices*

(c) *57 extension Supervisors areas*

(d) *512 extension Circles/cells*

(e) *200 Co-operative Societies*

(f) *56 Fadama User Associations*

(g) *16 Outgrower farmers*

(h) *6 Mango growers farmers*

(i) *27 Shelter Belts (30' x 2000')*

(j) *63064 Wind breaks/Boundary*

(k) *69 Wood lots (3-5 hecteres)*

(l) *15 Fishermen co-operative association*

(m) *3 Pasture fields (50 Hc)*

(n) *10 Nurseries for raising seedlings across the State.*

### 2.4.3 *SURVEYS, SHOWS, VISITS AND COURSES*

*The authority has conducted the following:-*

*(a) 50,000 farm visits*

*(b) 96 field days*

*(c) 46 Farmers tour*

*(d) 2 Agricultural shows*

*(e) 26 Mobile film shows*

*(f) 36 Economical/Ecological Surveys*

*(g) 200 Pasture Trails*

*(h) 9354 Short term courses (in-house and off project)*

*(i) 197 long term (OND/HND/PGD and Degree)*

*(j) 207 Certificates*

*(k) 36 Overseas training programmes e.t.c*

### 2.4.4 *PRODUCTIONS*

*The KTARDA has made the following productions:-*

*(a) 3363476 Forest tree Seedlings*

*(b) 275903 Fruits tree Seedlings*

*(c) 20,000 Bales*

*(d) 6 Newsletter Magazines*

*(e) 205 Naduke weekly TV programme*

*(f) 220 Kartau Sarkin Noma weekly Radio programme*

### 2.4.5 *INTRODUCTIONS*

*The authority has introduced the following:-*

*(a) 20 different livestock supplementary feed e.g porcoses, Urea, malasses, feed-block,Lab-lab, Stylo, Gamba, (Bales Kalgo/Gawo powder) etc.*

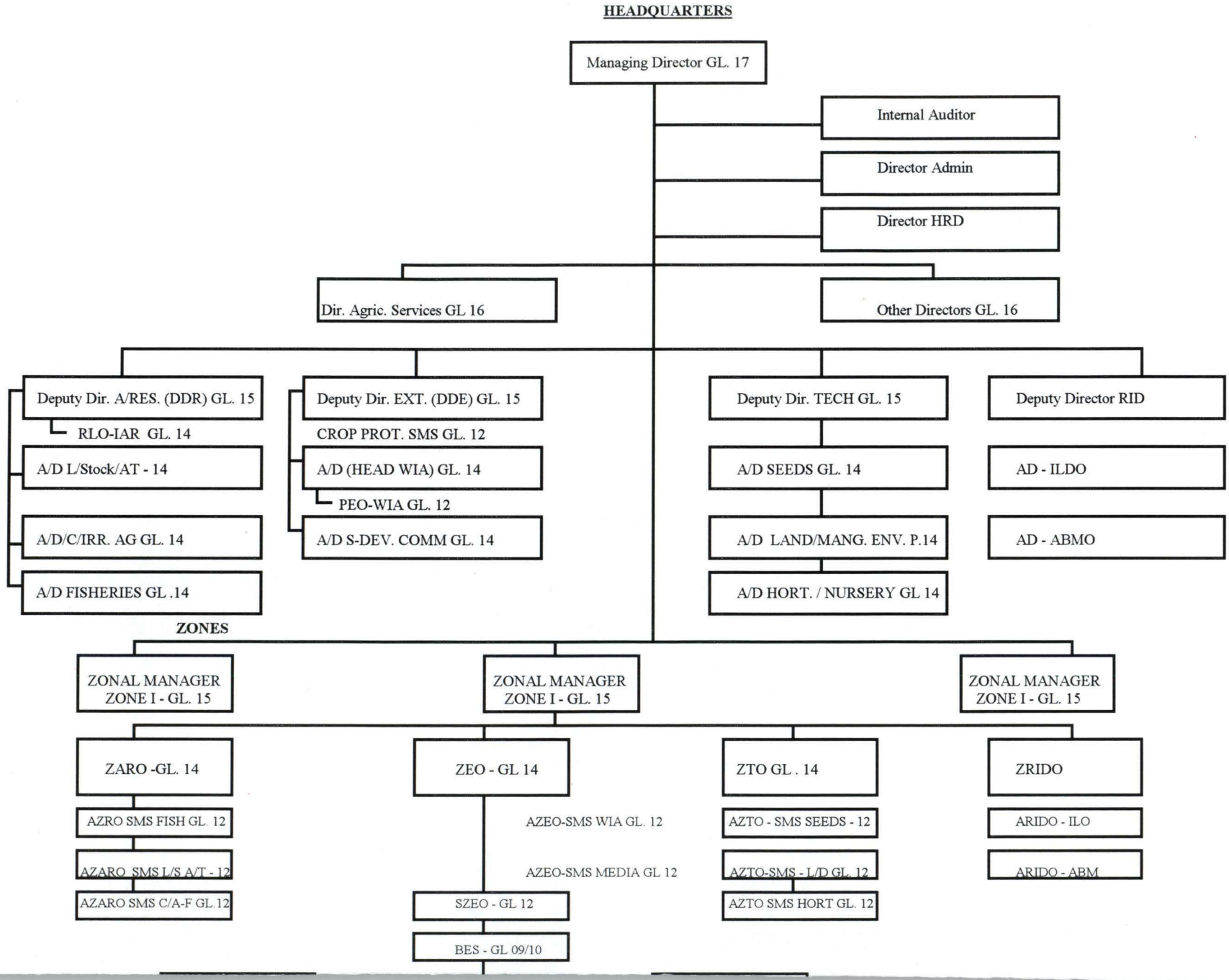
*(b) 10 Local herbs for local Pest Control measures e.g Dilo leaves, Doddoya leaves, Gogamasu, Gwandar daji leaves and Duman Rafi leaves.*

*(c) 2 different species of Vertica Grass for Biological control (Soil Conservation)*

*(d) Various species or namentals for beautification e.g Bongobolia e.t.c*

*(e) Various fish Culture Ponds for Small Scale farmers.*

3.4 **ORGANISATIONAL CHART**



## CHAPTER THREE

## STATISTICAL ANALYSIS AND COMMODITIES' PRICES

### 3.1 ANALYSIS OF VARIANCE (Comparison of more than two Samples).

*The appropriate procedure for testing the quality of several means of observation is the analysis of variance. It is probably the most useful technique in the field of statistical inference.*

*To determine whether 2 samples differ significantly, the F and T-test are more appropriate for such a statistical test. Whenever, there are more than two samples, these methods are unapplicable, and a different technique called analysis of variance is used instead.*

### 3.1.2 ONE - WAY ANALYSIS OF VARIANCE.

*This method should be used whenever there or more sets of readings are to be compared. First the mean value for each set of reading is calculated. Next the deviations (errors) for each set of readings are calculated as (reading - sample mean). Then the error square are summed, and the variances ( of the errors) is evaluated by dividing the sum of errors squared by the number of degrees of freedom (number of degrees of freedom is equal to the total number of readings minus (-) the number of sets).*

*The grand mean of all the values is calculated from the sum of the values divided by the number of values. The residuals between the sample means and the grand mean are evaluated, and the sum of their squares is collected and variance of the sample means. subsequently, the F ratio is calculated as :*

$$F = \frac{\text{Mean square for variance between sets}}{\text{Variance of the error.}}$$

### 3.2 ANALYSIS OF VARIANCE FOR THE PRICES OF MAIZE

*For example, to compare the prices of maize during the years as per the data in appendix II. The mean for each of the years is computed as follows:-*

***For 1983,***

$$\bar{x} = \sum xi/n$$

$$\bar{x} = \frac{212+210+242+\ldots+355+386}{12} = 301.33$$

*For 1984,*

$$\bar{x} = \frac{388+434+608+\ldots+654+738}{12} = 728.17$$

*For 1985.*

$$\bar{x} = \frac{722+692+722+---+361+335}{12} = 608.75$$

*For 1986,*

$$\bar{x} = \frac{328+722+390+---+338+315}{12} = 444.67$$

*For 1987,*

$$\bar{x} = \frac{315+694+367+---+510+510}{12} = 459.08$$

*Now we calculate the deviations (readings-sample mean) i.e X - $\bar{x}$ and this gives the following:*

| | JR | FB | MC | AP | MY | JN | JL | AG | ST | OT | NB | DB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1992 | -89.33 | -91.33 | -59.33 | -57.33 | 16.33 | 34.67 | 49.67 | 26.67 | -1.33 | 35.67 | 83.67 | 84.67 |
| 1993 | 340.17 | 294.17 | 120.17 | 89.83 | 101.17 | 66.83 | 449.83 | 241.83 | 130.83 | -59.17 | -74.17 | 9.83 |
| 1994 | 113.25 | 83.25 | 113.25 | 85.25 | 151.25 | 182.25 | 162.25 | 104.25 | 216.75 | 256.75 | 247.75 | 275.75 |
| 1995 | 116.67 | -76.67 | -54.67 | -21.67 | 32.33 | 76.33 | 80.33 | 51.33 | 21.33 | 109.67 | 106.67 | 129.67 |
| 1996 | 144.08 | 134.08 | 92.08 | 110.08 | -66.08 | -24.08 | 84.92 | -55.08 | 9.92 | 59.92 | 50.92 | 50.92 |

***TABLE 1.0***

*Then the squared deviation are calculated as (X-$\bar{x}$) and gives the following table.*

***DEVIATION SQUARED***

| MONTH | 1992 | 1993 | 1994 | 1995 | 1996 |
|---|---|---|---|---|---|
| JAN. | 7979.85 | 115715.60 | 12825.56 | 13611.89 | 20759.05 |
| FEB. | 8341.17 | 86536.00 | 6930.56 | 5878.29 | 17977.45 |
| MARCH | 3520.05 | 14440.83 | 12825.56 | 2988.81 | 8478.73 |
| APRIL | 3286.73 | 8069.43 | 7257.76 | 469.59 | 12117.61 |
| MAY | 266.67 | 10235.37 | 22876.56 | 1045.23 | 4366.57 |
| JUNE | 1202.01 | 4466.25 | 33215.06 | 5826.27 | 579.85 |
| JULY | 2467.11 | 202347.00 | 26325.06 | 6452.91 | 7211.41 |
| AUG. | 711.29 | 58481.75 | 10868.06 | 2634.77 | 3038.81 |
| SEPT. | 1.77 | 17116.49 | 46980.56 | 454.97 | 98.41 |
| OCT. | 1272.35 | 3501.09 | 65920.56 | 12027.51 | 3590.41 |
| NOV. | 7000.67 | 5501.19 | 61380.06 | 11378.49 | 2592.85 |
| DEC. | 7169.01 | 96.63 | 74939.06 | 16814.31 | 2592.85 |

*TABLE 2.0*

*Sum of deviation Squared =*

$= 7979.85+8341.17+3520.05+---+2592.85+2592.85=1208562.30$

$v_2$ *(degree of freedom)* $= 60 - 5 = 55$

$\therefore$ *the Variance of the error* $= \frac{\text{Sum of deviation squared}}{\text{Number of degree freedom}}$

$= 1208562.30 / 55$

$= 21973.86$

*To Calculate the grand mean, we have,*

$$\text{Grand mean} = \frac{n\bar{x}\,1+n\bar{x}\,2+n\bar{x}\,3+n\bar{x}\,4+n\bar{x}\,5}{N}$$

$$\frac{(301.33x12)+(728.17x12)+(608.75x12)+(444.69x12)+(459.08x12)}{60}$$

$$= \frac{30504}{60} \qquad = 508.4$$

*To Calculate the residuals between the sample mean and Grand mean, we proceed as follows:-*

| | ***Residual for the years are*** | ***Residual Squared*** | ***Residual Sqd x 12*** |
|---|---|---|---|
| *1992* | *301.33 - 508.40 = -207.07* | *42877.98* | *514535.82* |
| *1993* | *728.17 - 508.40 = 219.77* | *48298.85* | *579586.23* |
| *1994* | *608.75 - 508.40 = 100.35* | *10070.12* | *120841.47* |
| *1995* | *444.67 - 508.40 = -63.73* | *4061.51* | *48738.15* |
| *1996* | *459.08 - 508.40 = -49.32* | *2432.46* | *29189.55* |
| | | | ***1292891.23*** |

***Table 3.0***

$\therefore$ *The sum of the residual Squared Calculated above/the number of degree of freedom, we obtain the mean square for the Variance between years as*

$v_1 = 5 - 1 = 4$

$\therefore$ *Mean Square for Variance between year* $= \frac{1292891.23}{4} = 323222.81$

*Then the ratio of the mean square for between years variance to the mean square for the within years variance is given by*

$$F = \frac{\text{Variance for the mean square between years}}{\text{Variance for the mean square within years}}$$

$$= \frac{323222.81}{21973.86} \qquad = 14.71 \qquad = 15$$

## 3.3 ANALYSIS OF VARIANCE FOR THE PRICES OF MILLET

For 1992,

$$\bar{x} = \sum xi/n$$

$$\bar{x} = \frac{285+276+280+---+403+417}{12} = 320.42$$

For 1993,

$$\bar{x} = \frac{434+468+642+---+962+958}{12} = 836.08$$

For 1994,

$$\bar{x} = \frac{996+981+992+---+419+374}{12} = 787.42$$

For 1995,

$$\bar{x} = \frac{421+376+405+---+331+344}{12} = 376.50$$

For 1996,

$$\bar{x} = \frac{345+365+368+---+529+529}{12} = 435.00$$

### DEVIATIONS FROM THE MEAN

| | JR | FB | MC | AP | MY | JN | JL | AG | ST | OT | NB | DB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1992 | -35.42 | -44.42 | -40.42 | -31.42 | -8.42 | -7.42 | 3.58 | -18.42 | -47.42 | 50.58 | 82.58 | 96.58 |
| 1993 | 402.08 | -368.08 | -194.08 | 69.92 | -157.08 | -65.08 | 346.92 | 205.92 | 189.92 | 125.92 | 125.92 | 121.58 |
| 1994 | 208.58 | 193.58 | 204.58 | 129.58 | 212.58 | 230.58 | 231.58 | 106.58 | -334.42 | -401.42 | -368.42 | -413.42 |
| 1995 | 44.50 | -0.50 | 28.50 | 12.50 | 3.50 | 16.50 | 51.50 | 26.00 | -37.5 | -67.56 | -45.50 | -32.50 |
| 1996 | 90.00 | -70.00 | -67.00 | -71.00 | -104.00 | -83.00 | 54.00 | 80.00 | 46.00 | 117.00 | 94.00 | 94.00 |

TABLE 4.0

**DEVIATION SQUARED**

| MONTH | 1992 | 1993 | 1994 | 1995 | 1996 |
|---|---|---|---|---|---|
| JAN. | 1254.58 | 161668.33 | 43505.62 | 1980.25 | 8100.00 |
| FEB. | 1973.14 | 135482.89 | 37473.22 | 0.25 | 4900.00 |
| MARCH | 1633.78 | 37667.05 | 41852.98 | 812.25 | 4489.00 |
| APRIL | 987.22 | 4888.81 | 16790.98 | 156.25 | 5041.00 |
| MAY | 70.90 | 24674.13 | 45190.26 | 12.25 | 10816.00 |
| JUNE | 55.06 | 4235.41 | 53167.14 | 272.25 | 6889.00 |
| JULY | 12.82 | 120353.49 | 53629.30 | 2652.25 | 2916.00 |
| AUG. | 339.30 | 42403.05 | 11359.30 | 702.25 | 6400.00 |
| SEPT. | 2248.66 | 36069.61 | 111836.74 | 1406.25 | 2116.00 |
| OCT. | 2558.34 | 1585585 | 161138.02 | 4556.25 | 13689.00 |
| NOV. | 6819.46 | 15855.85 | 135733.30 | 2070.25 | 8836.00 |
| DEC. | 9327.70 | 14864.49 | 170916.10 | 1056.25 | 8836.00 |

*TABLE 5.0*

*Sum of deviation Squared*

$= 1254.58+1973.14+1633.78+---+13689+8836+8836$

$= 1622597.88$

$v_2$ *(degree of freedom)* $= 60 - 5 = 55$

$\therefore$ *the Variance of the error* $= \frac{\text{Sum of deviation squared}}{v_2}$

$= 1622597.88/55$

$= 29501.78$

$\text{Grand mean} = \frac{n\bar{x}\,1+n\bar{x}\,2+n\bar{x}\,3+n\bar{x}\,4+n\bar{x}\,5}{N}$

$= \frac{(320.42 \times 12)+(836.08 \times 12)+(787.42 \times 12)+(376.50 \times 12)+(435.00 \times 12)}{60}$

$= 33065.04/60 \qquad = 551.08$

***RESIDUAL BETWEEN SAMPLE AND GRAND MEAN***

| | ***Residual for the years*** | ***Residual Squared*** | ***Residual Sqd x12*** |
|---|---|---|---|
| *1992* | *320.42 - 551.08 = -230.66* | *53204.04* | *638448.48* |
| *1993* | *836.08 - 551.08 = 285.00* | *81225.00* | *974700.00* |
| *1994* | *787.42 - 551.08 = 236.34* | *55856.60* | *670279.20* |
| *1995* | *376.50 - 551.08 = -174.58* | *30478.18* | *365738.16* |
| *1996* | *435.00 - 551.08 = -116.08* | *13474.57* | *161694.84* |
| | | | ***2810860.68*** |

*TABLE 6.0*

$v_1 = 5 - 1 = 4$

$\therefore$ *Mean Square for Variance between year* $= \frac{2810860.68}{4} = 702715.17$

$F = \frac{\text{Variance for the mean square between years}}{\text{Variance for the mean square within years}}$

$= 702715.17/29501.78 = 23.82$

*3.4* ***ANALYSIS OF VARIANCE FOR THE PRICE OF GROUNDNUT***

$\bar{x} = \sum xi/n$

*For 1992,*

$\bar{x} = \frac{387+420+421+---+514+584}{12} = 490.5$

*For 1993,*

$$\bar{x} = \frac{741+910+1035+---+1037+1149}{12} = 1127.67$$

*For 1994,*

$$\bar{x} = \frac{862+922+991+---+807+814}{12} = 860.42$$

*For 1995,*

$$\bar{x} = \frac{1226+1173+2053+---+826+908}{12} = 1219.83$$

*For 1996,*

$$\bar{x} = \frac{896+954+1009+---+746+746}{12} = 1005.25$$

***DEVIATION FROM THE MEAN***

| MONTH | 1992 | 1993 | 1994 | 1995 | 1996 |
|---|---|---|---|---|---|
| JAN. | -103.5 | -386.67 | 1.58 | 6.17 | -109.25 |
| FEB. | -70.5 | -217.67 | 61.58 | -46.83 | -51.25 |
| MARCH | -69.5 | -92.67 | 130.58 | 833.17 | 3.75 |
| APRIL | -93.5 | 36.33 | 23.58 | 79.17 | -30.25 |
| MAY | -24.5 | 19.33 | 156.58 | 76.17 | -86.25 |
| JUNE | -18.5 | 70.33 | -50.42 | 813.17 | 28.75 |
| JULY | 121.5 | 217.33 | 86.58 | -44.83 | 432.75 |
| AUG. | 255.5 | 215.33 | 25.58 | -145.83 | 359.75 |
| SEPT. | -40.5 | 215.33 | -153.42 | -329.83 | 183.75 |
| OCT. | -73.5 | -79.67 | -182.42 | -534.83 | -213.25 |
| NOV. | -23.5 | -90.67 | -53.42 | -393.83 | -259.25 |
| DEC. | 93.5 | 21.33 | -46.42 | -311.83 | -259.25 |

*TABLE 7.0*

## DEVIATION SQUARED

| MONTH | 1992 | 1993 | 1994 | 1995 | 1996 |
|---|---|---|---|---|---|
| JAN. | 10712.25 | 149513.69 | 2.50 | 38.07 | 11935.56 |
| FEB. | 4970.25 | 47380.23 | 3792.10 | 2193.05 | 2626.56 |
| MARCH | 4830.25 | 8587.73 | 17051.14 | 694172.25 | 14.06 |
| APRIL | 8742.25 | 1319.87 | 556.02 | 6267.89 | 915.06 |
| MAY | 600.25 | 373.65 | 24517.30 | 5801.87 | 7439.06 |
| JUNE | 342.25 | 4946.31 | 2542.18 | 661245.45 | 826.56 |
| JULY | 14762.25 | 47232.33 | 7496.10 | 2009.73 | 187272.56 |
| AUG. | 65280.25 | 63166.77 | 654.34 | 21266.39 | 129420.06 |
| SEPT. | 1640.25 | 63166.77 | 23537.70 | 108787.39 | 33764.06 |
| OCT. | 5402.25 | 6347.31 | 33277.06 | 286043.13 | 45475.56 |
| NOV. | 552.25 | 8221.05 | 2853.70 | 155102.07 | 67210.56 |
| DEC. | 8742.25 | 454.97 | 2154.82 | 97237.95 | 67210.56 |

*Sum of deviation Squared =*

$$= 10712.25+4970.25+---+67210.56+67210.56$$

$$= 3239998.54$$

$v_2$ *(degree of freedom)* $= 60 - 5 = 55$

$\therefore$ *the Variance of the error* $= \dfrac{\text{Sum of deviation squared}}{v_2}$

$$= 3239998.54/55$$

$$= 58909.06$$

$$\text{Grand mean} = \frac{n\bar{x}\,1+n\bar{x}\,2+n\bar{x}\,3+n\bar{x}\,4+n\bar{x}\,5}{N}$$

$$= \frac{(490.5 \times 12)+(1127.67 \times 12)+(860.42 \times 12)+(1219.83 \times 12)+(1005.25 \times 12)}{60}$$

$$= 56444.04/60 \qquad = 940.73$$

## RESIDUAL BETWEEN SAMPLE AND GRAND MEAN

| | Residual for the years | Residual Squared | Residual Sqd x12 |
|---|---|---|---|
| 1992 | 490.50 - 940.73 = -450.23 | 202707.05 | 2432484.60 |
| 1993 | 1127.67 - 940.73 = 186 | 34946.56 | 419358.72 |
| 1994 | 860.42 - 940.73 = -80.31 | 6449.70 | 77396.40 |
| 1995 | 1219.83 - 940.73 = 279.10 | 77896.81 | 934761.72 |
| 1996 | 1005.25 - 940.73 = 64.52 | 4162.83 | 49953.96 |
| | | | **3913955.40** |

TABLE 9.0

$v_1 = 5 - 1 = 4$

$\therefore$ Mean Square for Variance between year $= \frac{3913955.4}{4} = 978488.85$

$F = 978488.85/58909.06$

$= \underline{16.61}$

## 3.5 ANALYSIS OF VARIANCE FOR THE PRICES OF RICE

$\bar{x} = \sum xi/n$

For 1992,

$$\bar{x} = \frac{494+570+532+---+664+655}{12} = 589.17$$

For 1993,

$$\bar{x} = \frac{577+654+1010+---+609+728}{12} = 936.42$$

For 1994,

$$\bar{x} = \frac{1072+1111+981+---+858+941}{12} = 1110.92$$

For 1995,

$$\bar{x} = \frac{1109+1083+1079+---+1094+1360}{12} = 1176.00$$

For 1996,

$$\bar{x} = \frac{1323+1314+1411+---+1772+1772}{12} = 1525.67$$

### DEVIATION FROM THE MEAN SQUARED

| MONTH | 1992 | 1993 | 1994 | 1995 | 1996 |
|---|---|---|---|---|---|
| JAN. | -95.17 | -359.42 | -38.92 | 13.00 | -202.67 |
| FEB. | -19.17 | -282.42 | 0.08 | -93.00 | -131.67 |
| MARCH | -57.17 | 73.58 | -129.92 | -97.00 | -114.67 |
| APRIL | -8.17 | 385.58 | 81.08 | -124.00 | 212.67 |
| MAY | -26..83 | -56..42 | 91.08 | -121.00 | -128.67 |
| JUNE | -22.17 | -162.42 | 204.08 | 45.00 | -29.67 |
| JULY | 52.83 | 534.58 | 237.08 | 192.00 | 252.33 |
| AUG. | 42.83 | 356.58 | 146.08 | 258.00 | 424.33 |
| SEPT. | 35.83 | 327.58 | 5.08 | -115.00 | 39.33 |
| OCT. | -97.17 | -281.42 | -172.92 | -60.00 | -388.67 |
| NOV. | 74.83 | -327.42 | -252.92 | -82.00 | 246.33 |
| DEC. | 65.83 | -208.42 | -169.92 | 184.00 | 246.33 |

TABLE 10.0

## *DEVIATION SQUARED*

| MONTH | 1992 | 1993 | 1994 | 1995 | 1996 |
|---|---|---|---|---|---|
| JAN. | 9057.33 | 129182.74 | 1514.77 | 169.00 | 41075.13 |
| FEB. | 367.48 | 79761.06 | 0.01 | 8649.00 | 17336.99 |
| MARCH | 3268.41 | 5414.02 | 16879.21 | 9409.00 | 13149.21 |
| APRIL | 66.75 | 148671.94 | 6573.97 | 15376.00 | 45228.53 |
| MAY | 719.85 | 3183.22 | 8295.57 | 14641.00 | 16555.97 |
| JUNE | 491.51 | 26380.26 | 41648.65 | 2025.00 | 880.31 |
| JULY | 2791.01 | 285775.78 | 56206.93 | 36864.00 | 63670.43 |
| AUG. | 1834.41 | 127149.30 | 21339.37 | 66564.00 | 180055.95 |
| SEPT. | 1283.79 | 107308.66 | 25.81 | 13225.00 | 1546.85 |
| OCT. | 944.01 | 79197.22 | 29901.33 | 3600.00 | 151064.37 |
| NOV. | 5599.53 | 107203.86 | 63968.53 | 6724.00 | 60678.47 |
| DEC. | 4333.59 | 43438.90 | 28872.81 | 33856.00 | 60678.47 |

*Sum of deviations Squared*

$= 9057.33+367.48+3268.41+\text{---}+60678.47+60678.47$

$= \underline{2311574.27}$

$v_2$ *(degree of freedom)* $= 60 - 5 = 55$

$\therefore$ *the Variance of the error* $= 2311574.27/55$

$= \underline{42028.62}$

*Grand mean* $= (589.17\,x12)+(936.42\,x12)+(1110.92\,x12)+(1176\,x12)+(1525.67\,x12)/60$

$= 64058.16/60 \qquad = \underline{1067.64}$

## *RESIDUAL BETWEEN SAMPLE AND GRAND MEAN*

| | Residual for the years | Residual Squared | Residual Sqd x12 |
|---|---|---|---|
| 1992 | 589.17-1067.64 =-478-47 | 228933.54 | **2747202.48** |
| 1993 | 936.42-1067.64 =-131.22 | 17218.69 | **206624.28** |
| 1994 | 1110.92-1067.64=43.28 | 1873.16 | **22477.92** |
| 1995 | 1176.00-1067.64=108.36 | 11741.89 | **140902.68** |
| 1996 | 1525.67-1067.64=458.03 | 209791.48 | **2517497.76** |
| | | | **5634705.12** |

*TABLE 12.0*

$v_1 = 5 - 1 = 4$

$\therefore$ *Mean Square for Variance between year* $= \dfrac{3913955.4}{4} = 978488.85$

$$F = 1408676.28/42028.62$$

$$= \underline{33.52}$$

## 3.6 ANALYSIS OF VARIANCE FOR THE PRICES OF GROUNDNUT

$$\bar{x} = \sum xi/n$$

**For 1992,**

$$\bar{x} = \frac{189+186+195+---+387+368}{12} = 252.17$$

For 1993,

$$\bar{x} = \frac{372+445+620+---+945+650}{12} = 783.33$$

For 1994,

$$\bar{x} = \frac{675+675+613+---+352+273}{12} = 628.33$$

For 1995,

$$\bar{x} = \frac{300+274+280+---+336+247}{12} = 327.50$$

For 1996,

$$\bar{x} = \frac{258+267+276+---+489+489}{12} = 360.25$$

### DEVIATION FROM THE MEAN SQUARED

| MONTH | 1992 | 1993 | 1994 | 1995 | 1996 |
|---|---|---|---|---|---|
| JAN. | -63.17 | -411.33 | 46..67 | -27.50 | -102.25 |
| FEB. | -66.17 | -338.33 | 46.67 | -53.50 | -93.25 |
| MARCH | -57.17 | -163.33 | -15.33 | -47.50 | -84.25 |
| APRIL | -48.17 | 86.67 | 87.67 | -6.50 | -8425 |
| MAY | -40.17 | -177.33 | 167.67 | -11.50 | -118.25 |
| JUNE | -24.17 | -111.33 | 189.67 | 1350 | -74.25 |
| JULY | -3117 | 344.67 | 179.67 | 93.50 | 79.75 |
| AUG. | -7.17 | 315.67 | 187.67 | 34.50 | 33.75 |
| SEPT. | -12.17 | 293.67 | -103.33 | 47.50 | 29.75 |
| OCT. | 98.83 | 132.67 | -173.33 | 29.50 | 155.75 |
| NOV. | 134.83 | 161.67 | -276.33 | 08.50 | 128.75 |
| DEC. | 115.83 | -133.33 | -355.33 | -80.50 | 128.75 |

TABLE 13.0

## *DEVIATION SQUARED*

| *MONTH* | *1992* | *1993* | *1994* | *1995* | *1996* |
|---|---|---|---|---|---|
| *JAN.* | *3990.45* | *169192.37* | *2178.09* | *756.25* | *10455.06* |
| *FEB.* | *4378.47* | *114467.19* | *2178.09* | *2862.25* | *8695.56* |
| *MAR.CH* | *3268.41* | *26676.69* | *235.01* | *2256.25* | *7098.06* |
| *APRIL* | *2320.35* | *7511.69* | *7686.03* | *42.25* | *7098.06* |
| *MAY* | *1613.63* | *31445.93* | *28113.23* | *132.25* | *13983.06* |
| *JUNE* | *584.19* | *12394.37* | *35974.71* | *182.25* | *5513.06* |
| *JULY* | *971.57* | *118797.41* | *39073.43* | *8742.25* | *6360.06* |
| *AUG.* | *51.41* | *99647.55* | *35220.03* | *1190.25* | *1139.06* |
| *SEPT.* | *148.11* | *86242.07* | *10677.09* | *2256.25* | *885.06* |
| *OCT.* | *9767.37* | *17601.33* | *30043.29* | *870.25* | *24258.06* |
| *NOV.* | *18179.13* | *26137.19* | *76358.27* | *72.25* | *16576.56* |
| *DEC.* | *13416.59* | *17776.89* | *126259.41* | *6480.25* | *16576.56* |

*TABLE 14.0*

*Sum of deviation Squared*

$= 3990.45+4378.47+3268.41+\text{---}+16576.56+16576.56$

$= 1325022.26$

$v_2$ *(degree of freedom)* $= 60 - 5 = 55$

$\therefore$ *The Variance of the error* $= 1325022.26/55$

$= \underline{\underline{24091.31}}$

$$\text{Grand mean} = \frac{(252.17 \times 12)+(783.33 \times 12)+(628.33 \times 12)+(327.50 \times 12)+(360.25 \times 12)}{60}$$

$= 28218.96/60$

$= \underline{\underline{470.32}}$

## *RESIDUAL BETWEEN SAMPLE AND GRAND MEAN*

| | ***Residual for the years*** | ***Residual Squared*** | ***Residual Sqd x12*** |
|---|---|---|---|
| *1992* | *252.17 - 470.43 =-218.15* | *47589.42* | *571073.07* |
| *1993* | *783.33 - 470.32 = 313.01* | *97975.26* | *1175703.12* |
| *1994* | *628.33 - 470.32 = 158.01* | *24967.16* | *299605.92* |
| *1995* | *327.50 - 470.32 = -142.82* | *20397.55* | *244770.63* |
| *1996* | *360.25 - 470.32 = -110.07* | *12115.40* | *145384.86* |
| | | | ***5634705.12*** |

*TABLE 15.0*

$v_1 = 5 - 1 = 4$

$\therefore$ *Mean Square for Variance between year* $= \frac{608984.40}{4} = 25.28$

$$F = \frac{608984.40}{24091.31} = \underline{\underline{25.28}}$$

$$F = \underline{\underline{25.28}}$$

## CHAPTER FOUR

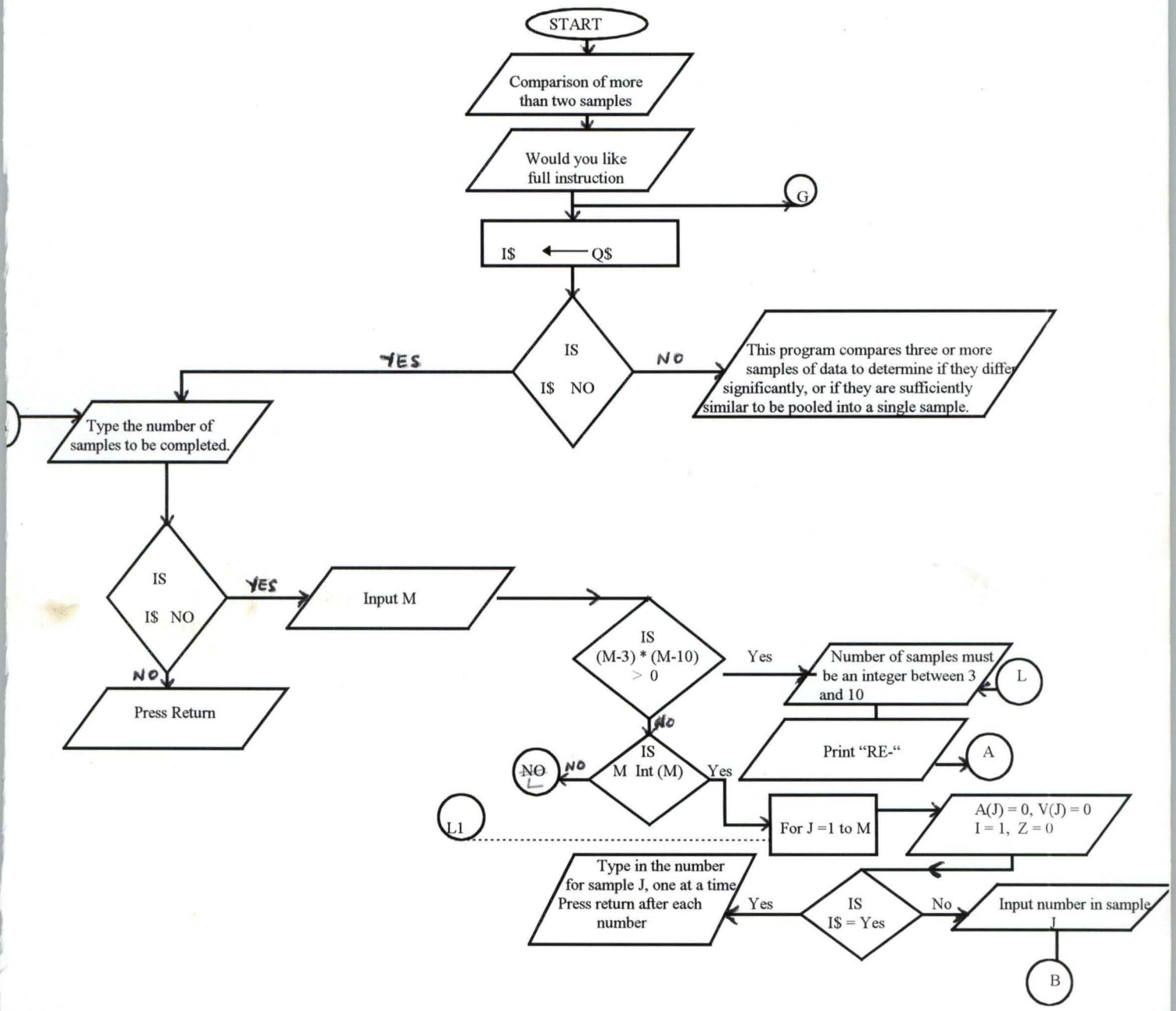
# 4.0 PROGRAM DESIGN AND TESTING

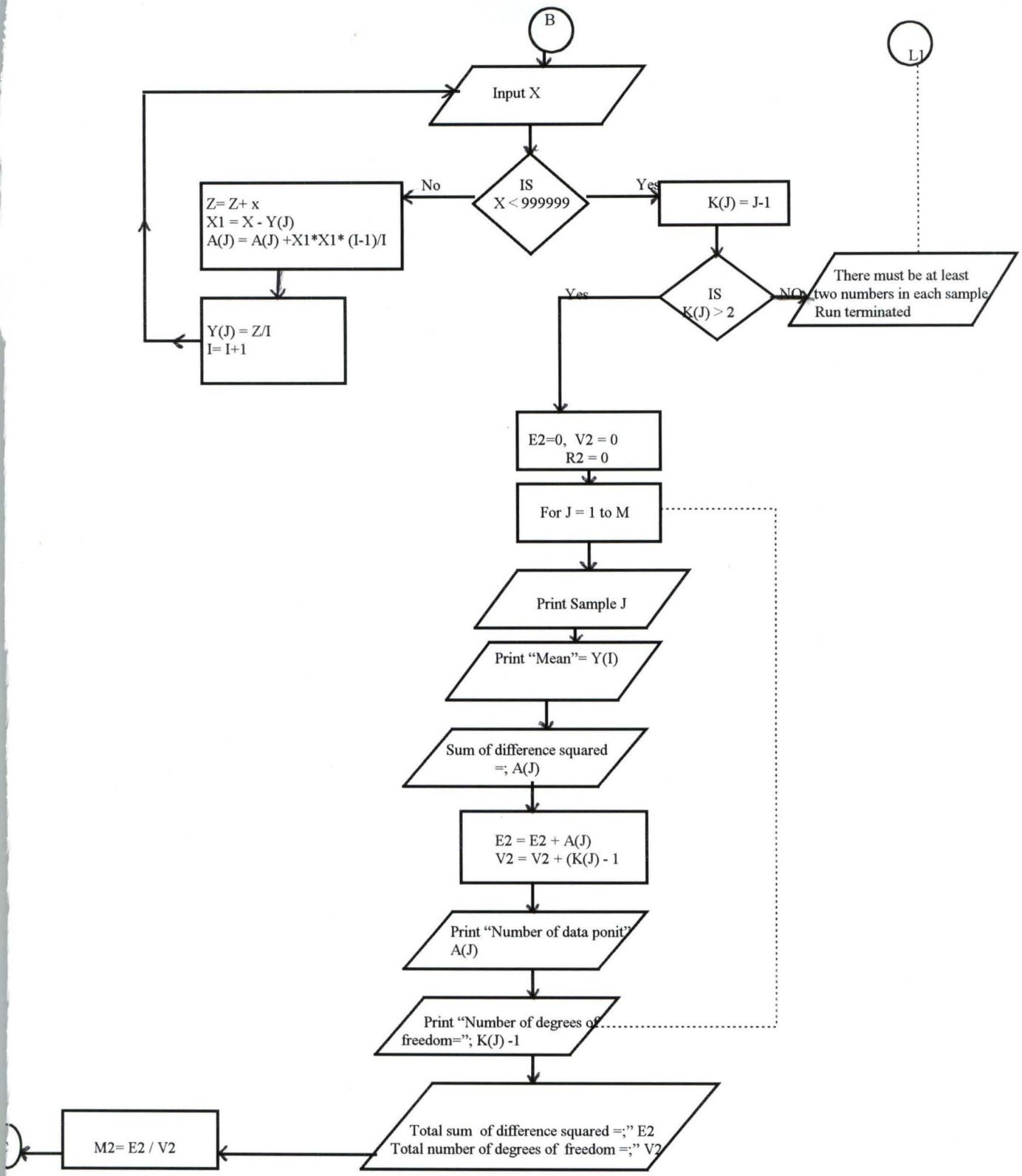
The program written (appendix I) to perform the comparison of the prices of each of the selected commodities is designed and tested as in 4.1 and 4.22 through 4.2.5 of this chapter for proper understanding of the statistical analysis carried out in Chapter 3 of this research.

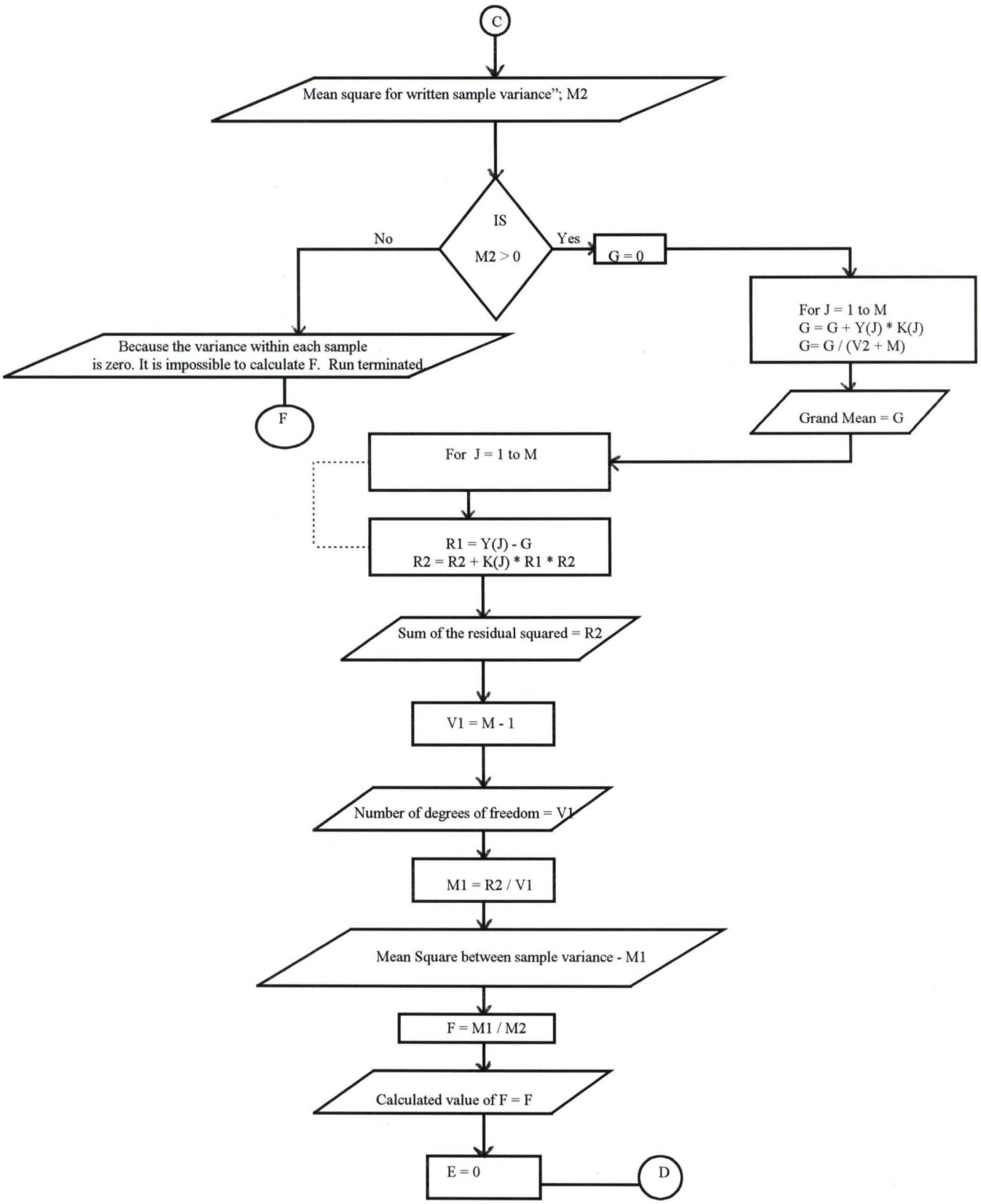
## 4.1 PROGRAM FLOWCHART

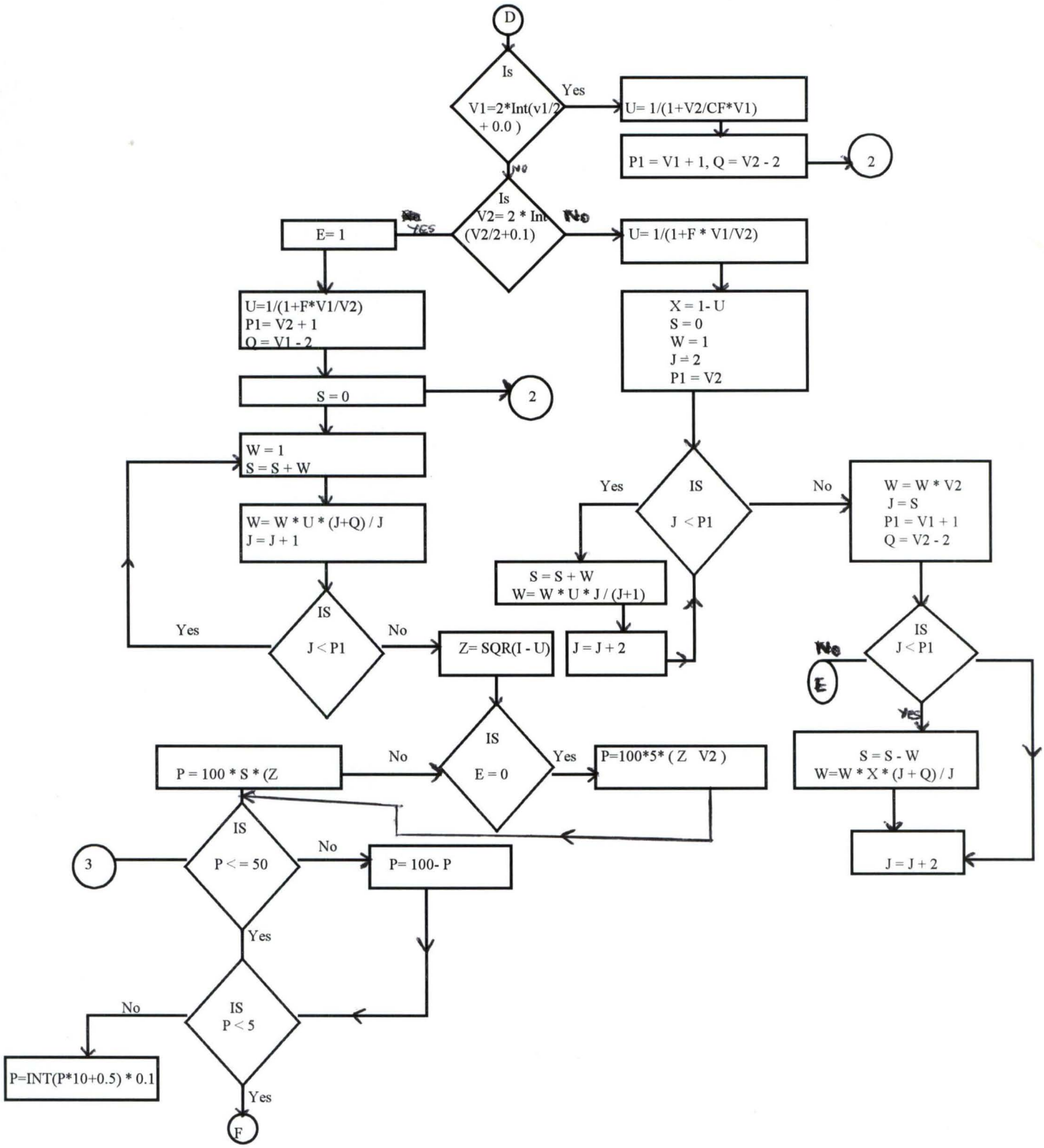
As programs become more complex, a flowchart is most helpful in planning , designing and structuring a program. A flowchart is a graphical representation of an algorithm i.e., it is a visual picture which gives the steps of an algorithm and also the flow of control between the various steps.

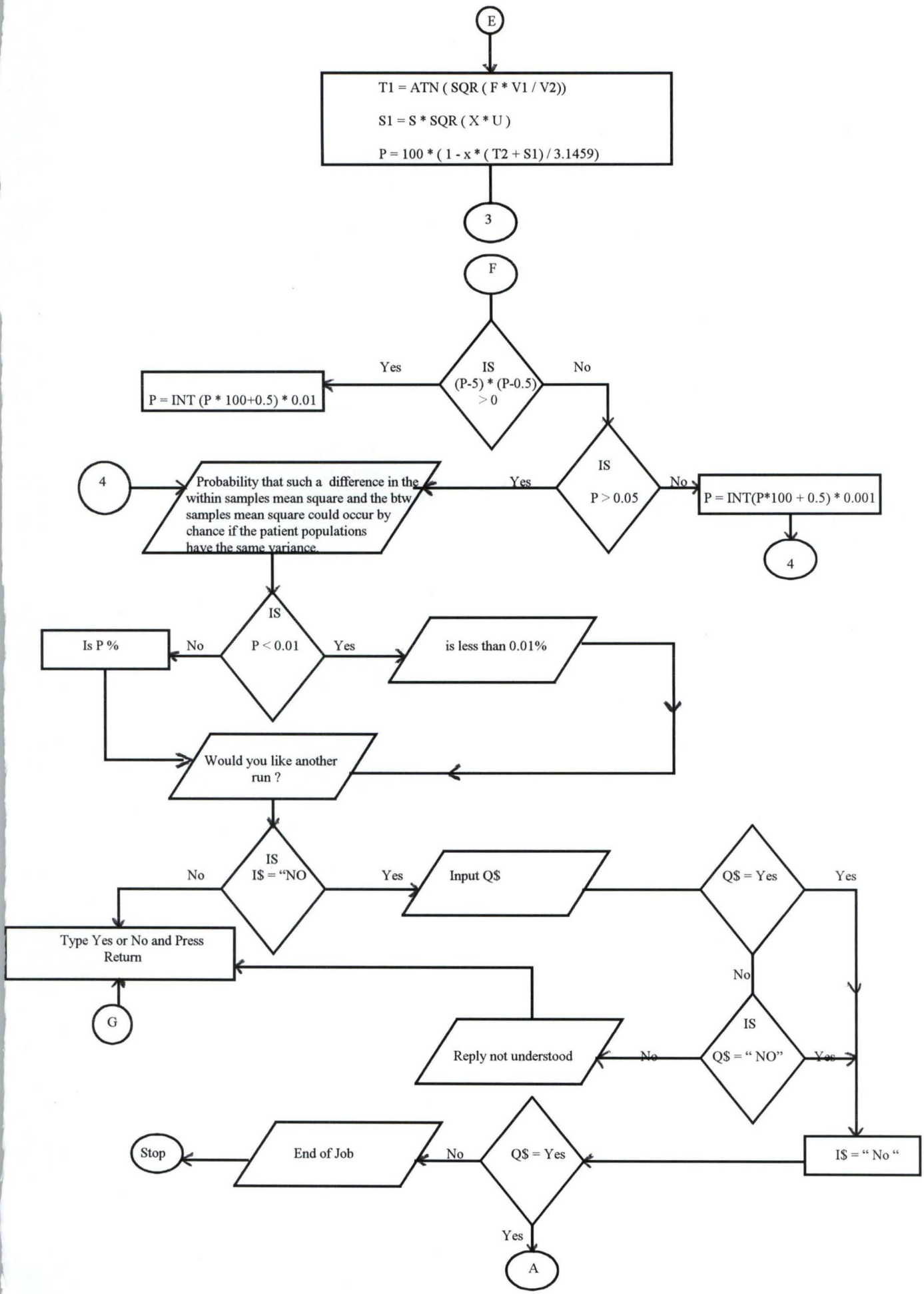
PROGRAM FLOWCHART




B
L1
Input X
IS
X < 999999
No
Yes
Z= Z+ x
X1 = X - Y(J)
A(J) = A(J) +X1*X1* (I-1)/I
Y(J) = Z/I
I= I+1
K(J) = J-1
IS
K(J) > 2
Yes
NO
There must be at least
two numbers in each sample
Run terminated
E2=0, V2 = 0
R2 = 0
For J = 1 to M
Print Sample J
Print "Mean"= Y(I)
Sum of difference squared
=; A(J)
E2 = E2 + A(J)
V2 = V2 + (K(J) - 1
Print "Number of data ponit"
A(J)
Print "Number of degrees of
freedom="; K(J) -1
Total sum of difference squared =;" E2
Total number of degrees of freedom =;" V2
M2= E2 / V2


C
Mean square for written sample variance"; M2
IS
M2 > 0
No
Yes
G = 0
For J = 1 to M
G = G + Y(J) * K(J)
G= G / (V2 + M)
Grand Mean = G
Because the variance within each sample
is zero. It is impossible to calculate F. Run terminated
F
For J = 1 to M
R1 = Y(J) - G
R2 = R2 + K(J) * R1 * R2
Sum of the residual squared = R2
V1 = M - 1
Number of degrees of freedom = V1
M1 = R2 / V1
Mean Square between sample variance - M1
F = M1 / M2
Calculated value of F = F
E = 0
D


D
Is V1=2*Int(v1/2 + 0.0 )
Yes
U= 1/(1+V2/CF*V1)
P1 = V1 + 1, Q = V2 - 2
2
No
Is V2= 2 * Int (V2/2+0.1)
Yes
E= 1
No
U= 1/(1+F * V1/V2)
U=1/(1+F*V1/V2)
P1= V2 + 1
Q = V1 - 2
X = 1- U
S = 0
W = 1
J = 2
P1 = V2
S = 0
2
W = 1
S = S + W
W= W * U * (J+Q) / J
J = J + 1
IS J < P1
Yes
No
S = S + W
W= W * U * J / (J+1)
J = J + 2
W = W * V2
J = S
P1 = V1 + 1
Q = V2 - 2
IS J < P1
Yes
No
E
S = S - W
W=W * X * (J + Q) / J
J = J + 2
IS J < P1
Yes
No
Z= SQR(I - U)
P = 100 * S * (Z
IS E = 0
Yes
No
P=100*5* ( Z V2 )
3
IS P < = 50
Yes
No
P= 100- P
IS P < 5
Yes
No
P=INT(P*10+0.5) * 0.1
F


E
T1 = ATN ( SQR ( F * V1 / V2))
S1 = S * SQR ( X * U )
P = 100 * ( 1 - x * ( T2 + S1) / 3.1459)
3
F
IS
(P-5) * (P-0.5)
> 0
Yes
P = INT (P * 100+0.5) * 0.01
No
IS
P > 0.05
No
P = INT(P*100 + 0.5) * 0.001
4
Yes
4
Probability that such a difference in the within samples mean square and the btw samples mean square could occur by chance if the patient populations have the same variance.
IS
P < 0.01
No
Is P %
Yes
is less than 0.01%
Would you like another run ?
IS
I$ = "NO
No
Yes
Input Q$
Q$ = Yes
Yes
Type Yes or No and Press Return
G
No
IS
Q$ = " NO"
No
Yes
Reply not understood
Stop
End of Job
No
Q$ = Yes
I$ = " No "
Yes
A

## 4.2 ***PROGRAM OUTPUT***

*The results of the computations for the selected commodities are as in section 4.2.1 through 4.2.5 with regards to the data on the prices of the commodities in appendix II of this research work.*

### 4.2.1 *COMPARISON OF MORE THAN TWO SAMPLE MAIZE PRICES*

*WOULD YOU LIKE INSTRUCTION*
*TYPE YES OR NO AND PRESS ENTER KEY*

*SAMPLE 1*
*MEAN = 301.3333*
*SUM OF DIFFERENCES SQUARED = 43218.67*
*NUMBER OF DATA POINT = 12*
*NUMBER OF DEGREES OF FREEDOM = 11*

*SAMPLE 2*
*MEAN = 728.1667*
*SUM OF DIFFERENCES SQUARED = 526507.6*
*NUMBER OF DATA POINT = 12*
*NUMBER OF DEGREES OF FREEDOM = 11*

*SAMPLE 3*
*MEAN = 608.75*
*SUM OF DIFFERENCES SQUARED = 382354.3*
*NUMBER OF DATA POINT = 12*
*NUMBER OF DEGREES OF FREEDOM = 11*

*SAMPLE 4*
*MEAN = 444.6667*
*SUM OF DIFFERENCES SQUARED = 150616.7*
*NUMBER OF DATA POINT = 12*
*NUMBER OF DEGREES OF FREEDOM = 11*
*SAMPLE 5*
*MEAN = 459.0833*
*SUM OF DIFFERENCES SQUARED = 120608.9*
*NUMBER OF DATA POINT = 12*
*NUMBER OF DEGREES OF FREEDOM = 11*

*TOTAL SUM OF DIFFERENCES SQUARED = 1223306*

*TOTAL NUMBER OF DEGREES OF FREEDOM = 55*

*MEAN SQUARED FOR WITHIN SAMPLE VARIANCE = 22241.93*

*GRAND MEAN = 508.4*

*SUM OF RESIDUALS SQUARED = 1292858*

*NUMBER OF DEGREES OF FREEDOM = 4*

*MEAN SQUARE FOR THE BETWEEN SAMPLES VARIANCES = 323214.6*

*CALCULATE VALUE OF F = 14.53177*

*PROBABILITY THAT SUCH A DIFFERENCE IN THE WITHIN SAMPLES*

*MEAN SQUARE AND BETWEEN SAMPLES MEAN SQUARE COULD*

*OCCUR BY CHANCE*

*IS .1369094 %*

4.2.2 ***COMPARISON OF MORE THAN TWO SAMPLE***

***MILLET PRICES***

*WOULD YOU LIKE INSTRUCTION*

*TYPE YES OR NO AND PRESS ENTER KEY*

*REPLY '5' NOT UNDER STOOD. TYPE YES OR NO AND PRESS ENTER KEY*

*SAMPLE 1*

*MEAN = 312.0833*

*SUM OF DIFFERENCES SQUARED = 26330.92*

*NUMBER OF DATA POINT = 12*

*NUMBER OF DEGREES OF FREEDOM = 11*

*SAMPLE 2*

*MEAN = 836.0833*

*SUM OF DIFFERENCES SQUARED = 614018.9*

*NUMBER OF DATA POINT = 12*

*NUMBER OF DEGREES OF FREEDOM = 11*

*SAMPLE 3*

*MEAN = 787.4167*

*SUM OF DIFFERENCES SQUARED = 882592.9*

*NUMBER OF DATA POINT = 12*

*NUMBER OF DEGREES OF FREEDOM = 11*

*SAMPLE 4*

*MEAN = 376.5*

*SUM OF DIFFERENCES SQUARED = 15677*

*NUMBER OF DATA POINT = 12*

*NUMBER OF DEGREES OF FREEDOM = 11*

*SAMPLE 5*

*MEAN = 435*

*SUM OF DIFFERENCES SQUARED = 83028*

*NUMBER OF DATA POINT = 12*

*NUMBER OF DEGREES OF FREEDOM = 11*

*TOTAL SUM OF DIFFERENCES SQUARED = 1621648*

*TOTAL NUMBER OF DEGREES OF FREEDOM = 55*

*MEAN SQUARED FOR WITHIN SAMPLE VARIANCE = 29484.5*

*GRAND MEAN = 549.4167*

*SUM OF RESIDUALS SQUARED = 2857683*

*NUMBER OF DEGREES OF FREEDOM = 4*

*MEAN SQUARE FOR THE BETWEEN SAMPLES VARIANCES = 714420.8*

*CALCULATE VALUE OF F = 24.23038*

*PROBABILITY THAT SUCH A DIFFERENCE IN THE WITHIN SAMPLES*

*MEAN SQUARE AND BETWEEN SAMPLES MEAN SQUARE COULD*

*OCCUR BY CHANCE*

*IS .1369283 %*

4.2.3 ***COMPARISON OF MORE THAN TWO SAMPLE GROUNDNUT PRICES***

*WOULD YOU LIKE INSTRUCTION*

*TYPE YES OR NO AND PRESS ENTER KEY*

*SAMPLE 1*

*MEAN = 490.5*

*SUM OF DIFFERENCES SQUARED = 126577*

*NUMBER OF DATA POINT = 12*

*NUMBER OF DEGREES OF FREEDOM = 11*

*SAMPLE 2*

*MEAN = 1127.667*

*SUM OF DIFFERENCES SQUARED = 400710.7*

*NUMBER OF DATA POINT = 12*

*NUMBER OF DEGREES OF FREEDOM = 11*

*SAMPLE 3*

*MEAN = 860.4167*

*SUM OF DIFFERENCES SQUARED = 118434.9*

*NUMBER OF DATA POINT = 12*

*NUMBER OF DEGREES OF FREEDOM = 11*

*SAMPLE 4*

*MEAN = 1219.833*

*SUM OF DIFFERENCES SQUARED = 2040166*

*NUMBER OF DATA POINT = 12*

*NUMBER OF DEGREES OF FREEDOM = 11*

*SAMPLE 5*

*MEAN = 1005.25*

*SUM OF DIFFERENCES SQUARED = 554110.3*

*NUMBER OF DATA POINT = 12*

*NUMBER OF DEGREES OF FREEDOM = 11*

*TOTAL SUM OF DIFFERENCES SQUARED = 3239999*

*TOTAL NUMBER OF DEGREES OF FREEDOM = 55*

*MEAN SQUARED FOR WITHIN SAMPLE VARIANCE = 58909.06*

*GRAND MEAN = 940.7333*

*SUM OF RESIDUALS SQUARED = 3913970*

*NUMBER OF DEGREES OF FREEDOM = 4*

*MEAN SQUARE FOR THE BETWEEN SAMPLES VARIANCES = 978492.4*

*CALCULATE VALUE OF F = 16.61022*

*PROBABILITY THAT SUCH A DIFFERENCE IN THE WITHIN SAMPLES*

*MEAN SQUARE AND BETWEEN SAMPLES MEAN SQUARE COULD*

*OCCUR BY CHANCE*

*IS .1369207 %*

4.2.3 ***COMPARISON OF MORE THAN TWO SAMPLE RICE PRICES***

*WOULD YOU LIKE INSTRUCTION*
*TYPE YES OR NO AND PRESS ENTER KEY*

*SAMPLE 1*
*MEAN = 589.1667*
*SUM OF DIFFERENCES SQUARED = 39255.67*
*NUMBER OF DATA POINT = 12*
*NUMBER OF DEGREES OF FREEDOM = 11*

*SAMPLE 2*
*MEAN = 936.4167*
*SUM OF DIFFERENCES SQUARED = 1142667*
*NUMBER OF DATA POINT = 12*
*NUMBER OF DEGREES OF FREEDOM = 11*

*SAMPLE 3*
*MEAN = 1110.917*
*SUM OF DIFFERENCES SQUARED = 275226.9*
*NUMBER OF DATA POINT = 12*
*NUMBER OF DEGREES OF FREEDOM = 11*

*SAMPLE 4*
*MEAN = 1176*
*SUM OF DIFFERENCES SQUARED = 211102.1*
*NUMBER OF DATA POINT = 12*
*NUMBER OF DEGREES OF FREEDOM = 11*

*SAMPLE 5*
*MEAN = 1525.667*
*SUM OF DIFFERENCES SQUARED = 651920.7*
*NUMBER OF DATA POINT = 12*
*NUMBER OF DEGREES OF FREEDOM = 11*

*TOTAL SUM OF DIFFERENCES SQUARED = 2320172*

*TOTAL NUMBER OF DEGREES OF FREEDOM = 55*

*MEAN SQUARED FOR WITHIN SAMPLE VARIANCE = 42184.95*

*GRAND MEAN = 1067.633*

*SUM OF RESIDUALS SQUARED = 5634713*

*NUMBER OF DEGREES OF FREEDOM = 4*

*MEAN SQUARE FOR THE BETWEEN SAMPLES VARIANCES = 1408678*

*CALCULATE VALUE OF F = 33.39291*

*PROBABILITY THAT SUCH A DIFFERENCE IN THE WITHIN SAMPLES*

*MEAN SQUARE AND BETWEEN SAMPLES MEAN SQUARE COULD*

*OCCUR BY CHANCE*

*IS .1369245 %*

4.2.3 ***COMPARISON OF MORE THAN TWO SAMPLE***

***GUINEA CORN PRICES***

*WOULD YOU LIKE INSTRUCTION*

*TYPE YES OR NO AND PRESS ENTER KEY*

*SAMPLE 1*

*MEAN = 252.1667*

*SUM OF DIFFERENCES SQUARED = 58689.67*

*NUMBER OF DATA POINT = 12*

*NUMBER OF DEGREES OF FREEDOM = 11*

*SAMPLE 2*

*MEAN = 783.3333*

*SUM OF DIFFERENCES SQUARED = 727890.7*

*NUMBER OF DATA POINT = 12*

*NUMBER OF DEGREES OF FREEDOM = 11*

*SAMPLE 3*

*MEAN = 628.3333*

*SUM OF DIFFERENCES SQUARED = 393996.7*

*NUMBER OF DATA POINT = 12*

*NUMBER OF DEGREES OF FREEDOM = 11*

*SAMPLE 4*

*MEAN = 327.5*

*SUM OF DIFFERENCES SQUARED = 25843*

*NUMBER OF DATA POINT = 12*

*NUMBER OF DEGREES OF FREEDOM = 11*

*SAMPLE 5*

*MEAN = 360.25*

*SUM OF DIFFERENCES SQUARED = 118638.3*

*NUMBER OF DATA POINT = 12*

*NUMBER OF DEGREES OF FREEDOM = 11*

*TOTAL SUM OF DIFFERENCES SQUARED = 1325058*

*TOTAL NUMBER OF DEGREES OF FREEDOM = 55*

*MEAN SQUARED FOR WITHIN SAMPLE VARIANCE = 24091.97*

*GRAND MEAN = 470.3167*

*SUM OF RESIDUALS SQUARED = 2436593*

*NUMBER OF DEGREES OF FREEDOM = 4*

*MEAN SQUARE FOR THE BETWEEN SAMPLES VARIANCES = 609148.1*

*CALCULATE VALUE OF F = 25.28428*

*PROBABILITY THAT SUCH A DIFFERENCE IN THE WITHIN SAMPLES*
*MEAN SQUARE AND BETWEEN SAMPLES MEAN SQUARE COULD*
*OCCUR BY CHANCE*
*IS .1369132 %*

## CHAPTER FIVE

## CONCLUSION AND RECOMMENDATIONS

### 5.1 CONCLUSION:-

*From the original prices of the five commodities shows how the actual prices use to fluctuate in each year from 1992 - 1996, the price fluctuations are without any definite pattern or uniformity in the fluctuations.*

*Prices variations can not be control, as a lot of effort had been done by the past governments to control it, but to no avail. The researcher has discovered that the prices can not be absolutely control, but the rate of fluctuations can be reducad to a barrest minimum. This could only be done after statistical survey on the prices, their causes, and the analysis of the prices. It is also discovered that the major problem that hinders such dynamic step is neglecting statistical advices based on such surveys.*

*Also from the ratio of the mean square for the between sets variance to the mean square for the within sets variance i.e the F - ratio for all the commodities considered proved that the calculated F exceeds the 5% value of 2.52 of the significance table for F - test. And this shows that there is less than a 5% chance that such prices could occur by chance if there were in reality no systematic difference in the years under study. Hence, the researcher thought on the causes of the price fluctuation in this country despite the mass agricultural production in Katsina state, and Nigeria in general. all tthese are due to the foolowing problem or causes.*

### 5.11 AGRO- CHEMICALS AND FERTILIZERS

*One of the contributing factor to the increase in the prices of agricultural commodities in the Katsina State, and Nigeria as a whole is the continous shortage of agro-chemicals and fertilizers. Small Scale Farmers used to find it difficult in purchasing them, hence, the high prices of Agro-chemicals and fertilizers. As a result the farmers find it necessary to sell their farm produce at higher prices, for them to balance the expenses incured in the production process.*

### 5.1.2 SMUGGLING :-

*Smuggling out of our Agricultural products is another factor that contribute immensely to the increase in the prices of these commodities in Katsina State being a border State in the Northern part of the country boardering some west Africancountries, some unpatriotic citizens exploit that opportunity to smuggle out these commodities to the neighbouring countries,*

*despite the anti-smuggle decree and tight custom guard. As a result food crops become less in the State, thus hike in their prices.*

*5.1.3* ***HOARDING*** *:-*

*Hoarding is also a factor that is contributing greatly to the hike in the pricesthrough out the state. Some of the well-to-do in the state use to buy the products in bulk with the aim of selling out when their prices have increase from 100% - 30% or more. This result to the law of supply in economics which says " The lower the supply of commodity to the market, the higher the prices of that commodity ".*

*5.1.4* ***TRANSPORTATION*** *:-*

*Due to the poor conditions of our roads and lack of sufficient vehicles to convey Agricultural Commodities form the rural areas to the urban area markets, the supply of these commodities tends to go below expectations. Hence, prices of such commodities will as well increase.*

*5.1.5* ***STORAGE AND PRESERVATION*** *:-*

*Lack of proper storage and preservation of the agricultural product affect the produce and hence, they affect their prices as well. Some of the crops were being affected by insects and rodents. Examples are maize, groundnut e.t.c Again apart from being affected by insects and rodents, there is the problem of poor preservation in terms of drying the commodities to the required moisture before storing them. As a result stored commodities spoils and damage after some times.*

*5.1.6* ***DEVALUATION*** *:-*

*The government's devaluation of Naira also determines the prices of commodities. It is generally noticed that when the value of Naira goes down, the prices of the imported agricultural commodities will go up. Hence, Naira value in the market determines the prices of agricultural produce.*

*5.2* ***RECOMMENDATIONS*** *:-*

*It is a well known fact that increase in the prices of agricultural commodities in any country is a clear indication that, the standard of living of the citizens of that country will be very low. Therefore, it becomes necessary for this type of survey to be carried out. In view of the findings in this chapter, the researcher strongly recommends the following :-*

*(i) The government should try as much as possible to make the needed agro-chemicals and fertilizers available and as well subsidised their prices to the reach of the small*

*scale farmers.*

(ii) *The federal government should note that the development of Nigeria's petro-chemical industry is long over due, for development of this industry will enable the various state governments to establish the Agro-chemicals and fertilizer producing industries in each of the states.*

(iii) *Smuggling out of Agricultural commodities should be curred instantly. Therefore, the government should deal ruthlessly with any person caught as it dem fit. Also, the tight custom exercise should be improved upon, because there seems to be some loop-holes in the custom services.*

(iv) *Government should employ all possible measures to stop the habit of hoarding throughout the country.*

(v) *The Government should rehabilitate our poor roads so that transportation of agricultural products to the markets may be eased. Also government should allow the importation of Spare Parts of the vehicles used for the transportation of the product to be cheaper and easier.*

(vi) *The government should educate farmers on storage and preservation techniques, so as to reduce the wastages as a result of insects, rodents and poor preservations.*

(vii) *The devaluation of our Naira did a lot of harm to our market prices and nation's economy as a whole. Therefore, it should be discourage.*

(viii) *An interest-free loan should be given to the farmers to assist them so that at the end, the prices of agricultural commodities will be reduced. In this research work, despite the data being a secondry one, the researcher find it difficult to compile the data because of its inconsistency. As a result, theauthority concerned should take appropriate action towards consistency of the data by impossing much strickness in the supervision of the enumerators and the compilation of the data. This is so because wrong data will result to poor planning or rather erronous data and destruction in the statistical analysis.*

```
10    DIM K(20), Y(20), Q&(20), I&(6)
20    PRINT TAB(15); " COMPARISON OF MORE THAN TWO SAMPLES"
30    PRINT TAB(15); "....."
40    PRINT
50    PRINT "WOULD YOU LIKE FULL INSTRUCTION"
60    GOSUB 1810
70    LET I$ = Q$
80    IF I$ = "NO" THEN 130
90    PRINT
100   PRINT "THIS PROGRAM COMPARES 3 OR MORE SAMPLES OF DATA TO"
110   PRINT "DETERMINE IF THEY DIFFER SIGNIFICANTLY, OR IF THEY ARE"
120   PRINT "SUFFICIENTLY SIMILAR TO BE POOLED INTO A SINGLE SAMPLE"
130   PRINT
140   PRINT "TYPE THE NUMBER OF SAMPLE TO BE COMPARED"
150   IF I$ = "NO" THEN 170
160   PRINT "THEN PRESS RETURN."
170   PRINT M
180   IF (M-3)*(M-10)>0 THEN 200
190   IF M = INT (M) THEN 230
200   PRINT "NUMBER OF SAMPLES MUST BE AN INTEGER BETWEEN 3&10."
210   PRINT
220   GO TO 140
230   REM START LOOP TO INPUT DATA
240   FOR J = 1 TO M
250   LET A(J) = 0
260   LET Y(J) = 0
270   LET I = 1
280   LET Z = 0
290   PRINT
300   IF I$ = "YES" THEN 330
310   PRINT "INPUT NUMBERS IN SAMPLE"; J
320   GO TO 350
330   PRINT "TYPE IN THE NUMBERS FOR SAMPLE" ; J; "ONE AT A TIME."
340   PRINT "PRESS ENTER KEY AFTER EACH VALUE."
350   PRINT "TYPE 999999 TO TERMINATE EXECUTION."
360   INPUT X
370   IF X = 999999 THEN 470
380   LET Z = Z+X
390   LET X1 = X-Y(J)
400   REM CALCULATE SUM OF DIFFERENCES SQUARED
```

```
410   LET A(J) = A(J)+X1*X1*(I-1)/I
420   REM CALCULATE MEAN OF SAMPLE
430   LET Y(J) = Z/I
440   LET I = I+1
450   GO TO 360
460   REM K(J) = NUMBER OF POINTS IN CURRENT SAMPLE
470   LET K(J) = I-1
480   IF K(J) > = 2 THEN 530
490   PRINT
500   PRINT "THERE MUST BE ATLEAST 2 NUMBERS IN EACH SAMPLE."
510   PRINT "RUN TERMINATED ON THIS DATA."
520   GO TO 1700
530   NEXT J
540   LET E2 = 0
550   LET V2 = 0
560   LET R2 = 0
570   REM LOOP TO PRINT STATISTICS FOR EACH SAMPLE
580   FOR J = 1 TO M
590   PRINT
600   PRINT "SAMPLE"; J
610   PRINT "MEAN = "; Y(J)
620   PRINT "SUM OF DIFFERENCES SQUARED ="; A(J)
630   LET E2 = E2+A(J)
640   LET V2 = V2+K(J)-1
650   PRINT "NUMBER OF DATA POINTS ="; K(J)
660   PRINT "NUMBER OF DEGREES OF FREEDOM ="; K(J)-1
670   NEXT J
680   PRINT
690   PRINT "TOTAL SUM OF DIFFERENCES SQUARED ="; E2
700   PRINT " TOTAL SUM OF DEGREES OF FREEDOM ="; V2
710   REM CALCULATE MEAN SQUARE FOR THE WITHIN SAMPLE VARIANCE
720   LET M2 = E2/V2
730   PRINT " MEAN SQUARE FOR WITHIN SAMPLES VARIANCE = " ; M2
740   IF M2 > 0 THEN 800
750   PRINT
760   PRINT " BECAUSE THE VARIANCE WITHIN EACH SAMPLE IS ZERO"
770   PRINT " IT IS IMPOSSIBLE TO CALCULATE THE TEST STATISTICS F. RUN ABANDONED"
780   GO TO 1710
790   REM CALCULATE GRAND MEAN G
800   LET G = 0
810   FOR J = 1 TO M
820   LET G = G+Y(J)*K(J)
```

```
830   NEXT J
840   LET G = G/(V2+M)
850   PRINT
860   PRINT " GRAND MEAN = " ; G
870   REM CALCULATE SUM OF RESIDUALS (SAMPLEMEAN-GRAND MEAN) SQUARED
880   FOR J = 1 TO M
890   LET R1 = Y(J) - G
900   LET R2 = R2+K(J)*R1*R1
910   NEXT J
920   PRINT " SUM OF RESIDUALS SQUARED = " ; R2
930   REM CALCULATE MEAN SQUARE FOR THE BETWEEN SAMPLE VARIANCE
940   LET V1 = M - 1
950   PRINT "NUMBER OF DEGREES OF FREEDOM = " ; V1
960   LET M1 = R2/V1
970   PRINT " MEAN SQUARE FOR THE BETWEEN SAMPLES VARIANCE = " : M - 1
980   REM CALCULATE THE TEST STATISTICS F
990   LET F = M1/M2
1000  PRINT
1010  PRINT
1020  PRINT " CALCULATED VALUE OF F = " ; F
1030  LET E = 0
1040  IF V1 = 2* INT(V1/2+0.1) THEN 1080
1050  IF V2 = 2* INT(V2/2+0.1) THEN 1130
1060  GO TO 1310
1070  REM CALCULATE PROBABILITY IF V1 IS EVEN
1080  LET U = 1/(1+V2/(F*V1)
1090  LET P1 = V1+1
1100  LET Q = V2-2
1110  GO TO 1170
1120  REM CALCULATE PROBABILITY IF V2 IS EVEN
1130  LET E= 1
1140  LET U=1/(1+F*V1/V2)
1150  LET P1 = V2+1
1160  LET Q = V1-2
1170  LET S = 0
1180  LET W = 1
1190  LET J = 2
1200  LET S = S+W
1210  LET W = W*U*(J+Q)/J
1220  LET J = J+2
1230  IF J < P1 THEN 1200
1240  LET Z = SQR(1-U)
```

```
1250  IF E=0 THEN 1280
1260  LET P = 100*5*(Z**V1)
1270  GO TO 1540
1280  LET P = 100*5*(Z**V2)
1290  GO TO 1540
1300  REM CALCULATE PROBABILITY IF V1 & V2 ARE BOTH ODD
1310  LET U = 1/(1+F*V1/V2)
1320  LET X=1-U
1330  LET S = 0
1340  LET W = 1
1350  LET J = 2
1360  LET P1 = V2
1370  GO TO 1410
1380  LET S = S+W
1390  LET W = W*U*J/(J+1)
1400  LET J = J+2
1410  IF J<P1 THEN 1380
1420  LET W = W*V2
1430  LET J = 3
1440  LET P1 = V1+1
1450  LET Q = V2 - 2
1460  GO TO 1500
1470  LET S = S - W
1480  LET W = W*X*(J+Q)/J
1490  LET J = J+2
1500  IF J < P1 THEN 1470
1510  LET T1 = ATN(SQR(F*V1/V2))
1520  LET S1 = S*SQR(X*U)
1530  LET P = 100*(1 -2*(T1+S1)/ 3.14159)
1540  IF P < = 50 THEN 1570
1550  LET P = 100 - P
1560  REM ROUND OFF ANSWER
1570  IF P < 5 THEN 1590
1580  LET P = INT (P*10+0.5)*0.1
1590  IF (P - 5)*(P - 0.5) > 0 THEN 1610
1600  LET P = INT (P*100+0.5)*0.01
1610  IF P > 0.05 THEN 1630
1620  LET P = INT (P*1000+0.5)*0.001
1630  PRINT " PROBABILITY THAT SUCH A DIFFERENCE IN THE WITHIN SAMPLES"
1640  PRINT " MEAN SQUARE AND THE BETWEEN SAMPLE MEAN SQUARE COULD"
1650  PRINT "OCCUR BY CHANCE"
1660  IF P < 0.01 THEN 1690
```

```
1670    PRINT "IS" ;P; "%"
1680    GO TO  1700
1690    PRINT  " IS LESS THAN 0.01%"
1700    PRINT
1710    PRINT
1720    PRINT "WOULD YOU LIKE ANOTHER RUN?"
1730    GOSUB  1800
1740    LET  I$ = "NO"
1750    RESTORE
1760    IF  Q$ = "YES"  THEN  130
1770    PRINT "END OF JOB"
1780    STOP
1790    REM ***** SUBROUTINE TO CHECK REPLIES****
1800    IF  I$ ="NO" THEN 1820
1810    PRINT "TYPE YES OR NO AND PRESS ENTER KEY"
1820    INPUT Q$
1830    IF Q$ = "YES" THEN 1870
1840    IF Q$ = "NO" THEN  1870
1850    PRINT "REPLY" ; Q$ ; " NOT UNDERSTOOD.";
1860    GO TO 1810
1870    RETURN
1880    END
```

## *APPENDIX II*

## *COMMODITIES PRICES IN (00) NAIRA PER TONNE*

### *MAIZE PRICES IN NAIRA PER TONNE*

| YEAR | JR | FB | MC | AP | MY | JN | JL | AG | ST | OT | NB | DC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1992 | 212 | 210 | 242 | 244 | 285 | 336 | 351 | 328 | 300 | 337 | 385 | 386 |
| 1993 | 388 | 434 | 608 | 818 | 627 | 795 | 1178 | 970 | 859 | 669 | 654 | 738 |
| 1994 | 722 | 692 | 722 | 694 | 760 | 791 | 771 | 713 | 392 | 352 | 361 | 335 |
| 1995 | 328 | 722 | 390 | 423 | 477 | 521 | 525 | 496 | 466 | 335 | 338 | 315 |
| 1996 | 315 | 694 | 367 | 349 | 393 | 435 | 544 | 404 | 469 | 519 | 510 | 510 |

### *MILLET PRICES IN NAIRA PER TONNE*

| YEAR | JR | FB | MC | AP | MY | JN | JL | AG | ST | OT | NB | DC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1992 | 285 | 276 | 280 | 289 | 312 | 313 | 324 | 302 | 273 | 371 | 403 | 417 |
| 1993 | 434 | 468 | 642 | 906 | 679 | 771 | 1183 | 1042 | 1026 | 962 | 962 | 958 |
| 1994 | 996 | 981 | 992 | 917 | 1000 | 1018 | 1019 | 894 | 453 | 386 | 419 | 374 |
| 1995 | 421 | 376 | 405 | 389 | 380 | 393 | 428 | 403 | 339 | 309 | 331 | 344 |
| 1996 | 345 | 365 | 368 | 364 | 331 | 352 | 489 | 515 | 481 | 552 | 529 | 529 |

### *GROUNDNUT PRICES IN NAIRA PER TONNE*

| YEAR | JR | FB | MC | AP | MY | JN | JL | AG | ST | OT | NB | DC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1992 | 387 | 420 | 421 | 397 | 466 | 472 | 612 | 746 | 450 | 417 | 514 | 584 |
| 1993 | 741 | 910 | 1035 | 1164 | 1147 | 1198 | 1345 | 1379 | 1379 | 1048 | 1037 | 1149 |
| 1994 | 862 | 922 | 991 | 884 | 1017 | 810 | 947 | 886 | 707 | 678 | 807 | 814 |
| 1995 | 1226 | 1173 | 2053 | 1299 | 1296 | 2033 | 1175 | 1074 | 890 | 685 | 826 | 908 |
| 1996 | 896 | 954 | 1009 | 975 | 919 | 1034 | 1438 | 1365 | 1189 | 792 | 746 | 746 |

### *RICE PRICES IN NAIRA PER TONNE*

| YEAR | JR | FB | MC | AP | MY | JN | JL | AG | ST | OT | NB | DC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1992 | 494 | 570 | 532 | 581 | 616 | 567 | 642 | 632 | 625 | 492 | 664 | 655 |
| 1993 | 577 | 654 | 1010 | 1322 | 880 | 774 | 1417 | 1293 | 1264 | 655 | 609 | 728 |
| 1994 | 1072 | 1111 | 981 | 1192 | 1202 | 1315 | 1348 | 1257 | 1116 | 938 | 858 | 941 |
| 1995 | 1189 | 1083 | 1079 | 1052 | 1055 | 1221 | 1368 | 1434 | 1061 | 1116 | 1094 | 1360 |
| 1996 | 1323 | 1394 | 1411 | 1313 | 1397 | 1496 | 1778 | 1950 | 1565 | 1137 | 1772 | 1772 |

***GUINEA CORN PRICES IN NAIRA PER TONNE***

| *YEAR* | *JR* | *FB* | *MC* | *AP* | *MY* | *JN* | *JL* | *AG* | *ST* | *OT* | *NB* | *DC* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *1992* | *189* | *186* | *195* | *204* | *212* | *228* | *221* | *245* | *240* | *351* | *387* | *367* |
| *1993* | *372* | *445* | *620* | *870* | *606* | *672* | *1128* | *1099* | *1077* | *916* | *945* | *650* |
| *1994* | *675* | *675* | *613* | *716* | *796* | *818* | *826* | *816* | *525* | *455* | *352* | *273* |
| *1995* | *300* | *274* | *280* | *321* | *316* | *341* | *421* | *362* | *375* | *357* | *336* | *247* |
| *1996* | *258* | *267* | *276* | *276* | *242* | *286* | *440* | *394* | *390* | *516* | *489* | *489* |

*KEY:-*

*JR - JANUARY, FB - FEBRUARY, MC - MARCH, AP - APRIL, MY - MAY, JN - JUNE, JL - JULY*

*AG - AUGUST, ST - SEPTEMBER, OT - OCTOBER, NB - NOVEMBER, DB - DECEMBER.*

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