Proceedings of the International Conference on Agricultural Postharvest Handling, and Processing (ICAPHP)

YANDRA ARKEMAI

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Indonesian Center for Agricultural Postharvest Research and Development

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The International Conference on Agricultural Postharvest Handling, and Processing (ICAPHP)

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FOREWORDS

International Conference on Agricultural Postharvest Handling, and Processing (ICAPHP), held in Jakarta on 19-21 November 2013. The background of the event implementation is that the improvement and the implementation of the agricultural technology for production, post harvest processing, and food safety is our main priority. In this case, innovative agriculture that makes the best use of available resources, maximizing quality, minimizing waste, and reusing resources whenever possible will become the key to meeting such challenging demands and the backbone of tomorrow's green economy. These crucial roles of agriculture require breakthroughs and integrated approaches in agricultural postharvest and processing technology.

For this reason, The Indonesian Agency for Agricultural Research and Development (IAARD), supported by FAO and International Commission of Agricultural and Bio systems Engineering (CIGR), is organizing a conference where international research scholars, academicians and practitioners from business and industry are invited. This conference is aimed at introducing and discussing recent advances in agricultural postharvest and processing technology. The scope of this conference covers: postharvest technology; plant factory, food processing technology, food engineering, food safety, agricultural waste processing technology and postharvest management, policy and regulation.

Indonesian Agency for Agricultural Research and Development (IAARD) under the Ministry of Agriculture is tasked to tackle the challenges that come with developing appropriate and practical agricultural policies based on science and technology. They are expected to not only do it on a macro level but also on small and micro levels that are directly related to agribusinesses and farmers.

IAARD, universities and other research institutions have produced many inventions in agriculture. Inventions are supposed to be transformed into innovation by commercially manufacturing the food products through implementing the developed inventions. Innovations in agricultural and food production and processing are expected to create new food materials that are ample for feeding the world population as well as ensure the food safety, and strengthen the food security.

This proceeding is published to be one of conference important points. Especially to disseminate the technology presented during the conference event and to gain the feedback on the aspect of scientific recognition and the breakthroughs in post-harvest technology readily applied in the field or the aspect of impact recognition.

Jakarta, November 2014

Authors

WELCOMING SPEECH

His Excellency Dr Rusman Heriawan, Vice Minister of Agriculture, Republic of Indonesia
His Excellency Prof Toshinori Kimura, Secretary General CIGR
His Excellency Mr Mustafa Emir, FAO Representative Indonesia
Colleagues in Ministry of Agriculture
Prominent Experts, and Invited Speakers,
Distinguish Ladies and Gentlemen,

First, let us say Grace to Allah SWT the Almighty God, for all His blessings so we could gather this time to take participation in the International Conference on Agricultural Postharvest Handling, and Processing at Jakarta, Indonesia.

Next, I would like to extent my warmest welcome to all of you to this exotic islands of pearls, Indonesia, and to this important conference for us to share experiences and learn best practices in agricultural operations.

Distinguish Participants,

As we all may understand, agriculture as the first step after the natural resources remains forever as the key capital to solve many current problems in the world such as food for the world hunger, biomass for bio-fuel production, and green technology to reduce the CO2 emission. Thus, agriculture becomes the main pillar to create the green economy. This means that the improvement and the implementation of the agricultural technology for production, post harvest processing, and food safety is our main priority.

The conference which will explore the emerging technologies from various prominent experts around the world is a vehicle to promote further the agricultural technology implementation in supporting the green technology. The scope of this conference covers 11 invited papers presenting environmental and friendly bio-based technology, emerging food chain system, non-destructive quality analysis, plant factory, precision agriculture, active and smart packaging, and halal food. Further, there are 40 oral presentations, and 39 posters in the areas of novel technology in plant factory, post harvest handling technology, food processing technology, grain handling and quality, post harvest quality and management, and nanotechnology applications in food and agricultural products. We are also grateful that there participants coming from far like from Australia, Japan, Thailand, Taiwan, FAO Rome, and IRRI Philippines, not to mention our dear colleagues from all over Indonesia.

We have also various important activities on the site of the conference such as the launching of the premiere mango export using Controlled Atmosphere to Dubai, bilateral and business meeting, and exhibition.

In closing, I would like to wish you all a most successful and useful deliberation for the development of green economy in the world. Enjoy your stay in Jakarta.

Jakarta, 19 November 2013

Dr. Haryono, M.Sc.
The Director General of IAARD

REMARKS OF FAO REPRESENTATIVE

Your Excellency, Suswono, Minister of Ariculture, Republic of Indonesia
Mr. Toshimori Kimura, Secretary General of CIGR
Dr. Haryono, DG of Indonesian Agency of Agricultural
Eugenia Serova from FAO HQ
Distinguished Invitees
Ladies and Gentelmen,

I wish you a good morning. Selamat Pagi.
At the outset, I would like to welcome all of you.
I am pleased, I would like to welcome all of you.
Conference on Agricultural Postharvest Handling and Processing with the theme "Breakthroughs in Postharvest and Processing Technology As The Backbone of Tomorrow's Green Economy."

This Conference is coincided with the save food campaign of FAO, Which highlights the importance of food waste and losses in a world where food security and malnutrition is one of major concerns in a degraded environment under effects of climate change.

On this occasion I wish to draw your attention to the result of an FAO-commissioned study.

Nearly one third of the food produced in the world for human consumption every year is lost or wasted, according to the study. As a companion to its new study, FAO has also published a comprehensive "tool-kit" that contains recommendations on how food loss and waste can be reduced at every stage of the food chain.

Key findings from the study Include:

- Industrialized and developing countries disspate roughly the same quantities of food- respectively 670 and 630 nilion tonnes.
- Every year, consumers in rich countries waste almost as much food as the entire net food production of sub-Saharan Africa.
- Fruits and Vegetables, plus roots and tubers have the highest wastage rates of any food.
- The amount of food lost or wasted every year is equivalent to more than half of the wold's annual cereals crop.

Losses and Waste

Food Losses – occurring at the production, harvest, post-harvest and processing phases – are most important in developing countries, due to poor infrastructure, low levels of technology and low invesstment in the food production systems.

Food Waste is more a problem in Industrilized countries,most often caused by both retailers and consumers throwing perfectly edible foodstuffs into the trash. Per capita waste by consumers is between 95-115 kg a year in Europe and North America, while consumers in sub-Saharan Africa and South and Southeast Asia Each throw away only 6-11 kg a year.

In developing countries 40 percent of losses occur at post-harvest and processing level while in industrialized countries more than 40 percent of losses hapen at retail and consumer levels.

Food losses during harvest and in storage translate into lost income for small farmers and into higher prices for poor consumers, the report noted. Reducing losses could therefore have an "immediate and significant" impact on their livelihoods and food security.

Squandering resources

Food loss and waste also amount to a major squandering of resources. including water, land, energy, labour and capital and needlessly produce greenhouse gas emissions, contributing to global warming and climate change.

In developing countries the problem is chiefly one of indequate harvest techniques, poor post-harvest management and logistics, lack of suitable infrastructure, processing and packaging, and lack of marketing information which would allow production to better match demand.

Where wastage happens 54% of the wold's food wastage occurs "upstream" during production, post-harvest handling and storage, according to FAO's study. 46% of it happens "downstream" at the processing, distribution and consumption stages.

As a generaltrend, developing countries suffer more food losses during agricultural production, while food waste at the retail and consumer level tends to be higher in midle and high-income regions.

Strengthening the food supply chain by assisting small farmers to link directly to buyers is a importance. The private andpublic sectors should also invest more in infrastructure, transportation and in processing and packaging. Reducing food wastage, re-using within the human food chain, recycling and recovery are the main steps to follow.

I have a firm belief that this conference would contributr to reduce the postharvest losses and waste through use of postharvest and processing technology, raging from "rural technology" or "grass roots technology" to recent modern technology for better future.

I wish you a successful, fruitful conference.

Thank you, terima kasih.

Jakarta, 19 November 2013

Mustafa IMIR
FAO Representative

REMARKS OF CIGR JAPAN

His Excellency Dr Rusman Heriawan, Vice Minister Of Agriculture, Republic Of Indonesia
His Excellency Dr. Haryono, The Director General Of Iaard Indonesia
His Excellency Mr Mustafa Imir, Fao Representative Indonesia
Colleagues In Ministry Of Agriculture
Prominent Experts, And Invited Speakers.
Distinguish Ladies And Gentlemen,

First, I Would Like To Extent My Warmest Appreciation To All Of You To Meet In This Exotic Islands Of Pearls, Indonesia, And To This Important Conference For Us To Share Experiences And Learn Best Practices In Agricultural Operations.

Distinguish Ladies And Gentlemen,

As We All May Understand, Agriculture As The First Step After The Natural Resources Remains Forever As The Key Capital To Solve Many Current Problems In The World Such As Food For The World Hunger, Biomass For Biofuel Production, And Green Technology To Reduce The Co2 Emission. Thus, Agriculture Becomes The Main Pillar To Create The Green Economy.

The International Commission Of Agricultural Bio Systems Engineering (Cigr) Proudly Supported This Conference Which Will Explore The Emerging Technologies From Various Prominent Experts Around The World, That It Is A Vehicle To Promote Further The Agricultural Technology Implementation In Supporting The Green Technology. This Spirit Is In Line With Purpose Of Cigr That The Improvement And The Implementation Of The Agricultural Technology For Production, Post Harvest Processing, And Food Safety As Well As The Managing Landscape Through The Advancement Of Engineering And Allied Sciences.

As We Know Cigr Body Consisting Of A Few Countries In Europe Was Organized At Liege, Belgium In 1930. It Expanded Its Activity To Global Level In 1989, And This Time The Cigr Has 33 Member Bodies Including 95 Countries , Indonesia The Newest National Member. And The General Secretariat Is At Hokkaido University, Sapporo, Japan. The Liaison Organizations Of Cigr Are Fao, Iso, Oecd, Unido, Csam And Club Of Bologna. One Of The Activities Of Cigr Is Supporting Or Sponsoring Conferences, Symposium, And Publishing The Cigr Journal And Cigr Newsletter, As Well As Establishing 11 Working Groups.

Distinguished Ladies And Gentlemen

We Are Also In Debt With The Iaard In Inviting Cigr And We Are Accepting Indonesia As The Cigr Member Represented By Iaard Interchange With The Association Of Agroindustrial Technology Profession. More Over On Behalf The Cigr, I Would Like To Thank Also To All The Contributors To This Conference, Who Will Outline Their Invaluable Ideas, Please, Accept Our High Appreciation.

Finally, I Would Like To Congratulate To Iaard For Successful Organizing The International Conference And I Wish You All The Most Successful And Useful Deliberation For The Development Of Green Economy In The World.

Jakarta, 19 November 2013

Prof. Toshinori Kimura
Secretary General Of CIGR

OPENING REMARKS

Excellencies :

- Deputy, Vice Ministers,
- The representative of FAO, IRRI, ACIAR
- Secretary General of CIGR (Commission of Agricultural and Biosystem Engineering)
- Distinguished Participants
- Ladies and Gentlemen

Assalammu'alaikum wa Ramatullahi wa Barakatuh,

First of all, let us say Grace to the Almighty God, Allah Subhanahu Wa' Ta'ala, as His Will that we are gathered today in healthy condition, to take part on the International Conference on Agricultural Postharvest Handling and Processing in Jakarta. I would like to recall that coincides with the Asia-Pacific Economic Cooperation (APEC) Summit Meeting last month in Bali, there are two important agenda that Indonesian Government focused on, which has a close relevance to this conference, i.e. development of micro, small and medium enterprises (SMEs) and agriculture.

Indonesian Government is working hard to develop and promote SMEs and agricultural products in order to enter the world market, in particular APEC Countries, without barrier problems. The development of the two sectors require a careful strategy and effort, from upstream to downstream, so that it can play a significant role in the growth of the national economy. Indonesia's economic growth rate at this second quarter of 2013 is 5.81%, lower than that in the previous year (2012) of 6.23%.

Efforts to increase the economic growth through the development of agricultural sector should be done optimally given the context of efforts to reduce unemployment and poverty, which shows a continuous decline from year to year. I think, Indonesian Agency for Agricultural Research and Development (IAARD) - Ministry of Agriculture has a difficult task to develop appropriate and practical agricultural policy with science- and technology-based, not only at macro level but also at the small and micro level directly related to agribusinesses and farmers.

Distinguished Participants,

The focus of Government attention on the two APEC agenda is also in-line with anticipatory strategy against global issues today, which are closely related to the agricultural sector regarding foods, feeds, renewable fuels, fibers and environment. The strategic role of agricultural sector in answering these global challenges, among others, are (a) provider of foods for all Indonesian people, to achieve food sovereignty; (b) provider of the majority (> 80%) of raw materials for small and medium enterprises that are expected to contribute significantly to the growth of national economy; (c) main source of income of rural households to lower the unemployment rate as well as the alleviation of poverty; (d) source of biodiversity and environmental conservation that are expected to contribute to the reduction of greenhouse gas emissions (GHG) as mandated by Presidential Decree No.61, year 2011; and (e) contributor to Gross Domestic Product (GDP) and the State foreign exchange earner.

Ladies and gentlemen,

We know that the year 2014 is the last year of the Strategic Plan of Ministry of Agriculture with four success targets. Yet in my opinion, the success targets are still relevant to be continued in the next period, with of course, different approaches.

The achievement of four successes becomes the basic foundation for the development of sustainable agricultural industry systems as listed as the vision of the Ministry of Agriculture for the period of 2015-2019. Even so, the whole range of the Ministry of Agriculture should review their work performances, and then formulate the concrete steps to complete the targets for the year 2014. We hope this conference produces strategic formulations to support the achievement of the targets.

Distinguished participants,

This conference is greatly appreciated considering the closely related theme to agricultural bio-industry system being developed to meet the new economic era in the coming decade. In this conference, we have the opportunities to share knowledge and ideas, to share what we have done, and to share what we can offer to answer these global challenges. Further, we have also the opportunity to develop scientific network and collaboration. Global collaboration network is very important to optimize the research results and the use of limited resources.

We expect the agricultural sector downstream activities become more solid and reliable with the application of a variety of post-harvest technology innovations, as well as upstream activities with pre-harvest technology innovations. The integration of both upstream and downstream agricultural development will provide the answers to the challenge of open trade in APEC and ASEAN Economic Community in the coming years.

By saying "Bismillahirrohmanirrohim", I declare the International Conference on Agricultural Postharvest Handling and Processing with the theme "Breakthrough in Postharvest and Processing Technology as the Backbone of Tomorrow's Green Economy" officially open. Congratulations, I wish we are all having a fruitful discussion and for all the international participants welcome and enjoy your visit to Jakarta.

Billahit taufiq walhidayah,
Wassalamu'alaikum wa rohmatullahi wa barokatoh

Jakarta, 19 November 2013

Dr. Rusman Heriawan
Vice Minister of Agriculture, Republic of Indonesia

PREFACE

The papers contained report the peer reviewed Proceeding of the International Conference on Agricultural Postharvest Handling and Processing (ICAPHP). Keynote speakers and authors of selected contributed oral and poster presentations were given the opportunity to submit a manuscript for publication.

The manuscripts were reviewed by the Editors and members of the Editorial Board. Only those papers judged suitable for publication following the authors' consideration of reviewer suggestions appear in this proceeding.

The IAARD acknowledge and appreciates the contribution of all editors and reviewers. They have made a significant contribution to improving the quality of this publication.

Jakarta, 19 November 2014

Dr. Haryono, M.Sc.
The Director General of IAARD

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LIST OF AUTHORS

Fuzzy Clustering in Grouping Traditional Market Distribution and Genetic Algorithm Application in Routing of Packed Cooking Oil Distribution

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Keywords : Fuzzy clustering, transportation salesperson problem, genetic algorithm, packaging cooking oil

Abstract

This paper presents the modelling of intelligent routing of transportation of packaging cooking oil from the distribution center to traditional market in the cluster in Indonesia, especially in Jakarta. Indonesia is the nation who has many islands. Every island has different population of people. Everyday many people go to traditional market to buy main consumption products like palm oil etc. Price of palm oil is very sensitive to increase when it lack at the market, so sustainability of present palm oil at the market is very important. Focus of this research is to demonstrate how to optimize routing distribution from distribution centre to markets in the cluster. Optimum route hopefully can guarantee the availability of product and stock in the market to maintaining the price. The clustering is created by fuzzy clustering and the routing is created by Transportation Salesperson Problem (TSP) with Genetic Algorithm (GA) method. Genetic algorithm is a method for solving optimization problem that based on evolutionary theory in biology.

Introduction

The movement of finished product to customers is market distribution. In market distribution, the end customer represents the final destination (Bowersox, 2002). The ability to deliver goods as customer ordered is service. It will be call logistic which are integrated production and distribution, The logistics components of a corporation consist of: (1) a number of manufacturing plants, (2) zero, one, or more distribution echelons with distribution centres, (3) the customers, (4) the suppliers of components and raw materials, (5) recycling centres for used products and returned packaging containers, and finally (6) the transportation channels that link all of the above components (Goetschalckx, et .al, 2002).

Indonesia is the nation who has many islands. Every island has different population of people. Every region has many traditional markets to serve daily people consumption. These traditional markets need distribution centre to ensure availability of consumption product in these traditional markets. How to optimum determine distribution centre of each region can define by clustering. Hamzah (2001) show that clustering process by fuzzy (fuzzy clustering) gives the result better that defined it by firm directly approaches. In this paper we focus on Jakarta region.

Jakarta is capital city of Indonesia, which have 5 regionch are North Jakarta, South Jakarta, West Jakarta, East Jakarta and Central Jakarta (Figure 1). Traditional market in Jakarta is coordinated by PD Pasar Jaya. PD Pasar Jaya have 153 traditional market (figure 2). Every traditional market uncontrolable availability of goods and disparity of goods prices. So this paper will purpose to make distribution centre to solve this problem.

Distribution centre will be created by fuzzy clustering. Partition clustering essentially eals with the task of partitioning a set of entities into a number of homogeneous clusters, ·ith respect to a suitable similarity measure. Due to the fuzzy nature of many practical roblems, a number of fuzzy clustering methods have been developed following the general ızzy set theory strategies outlined by Zadeh (1965). The main difference between the aditional hard clustering and fuzzy clustering can be stated as follows: in hard clustering n entity belongs only to one cluster, while in fuzzy clustering entities are allowed to belong › many clusters with different degrees of membership.

Clustering has been around for many decades and located itself in a unique position s a fundamental conceptual and algorithmic landmark of data analysis. Almost since the ery inception of fuzzy sets, the role and potential of these information granules in revealing nd describing structure in data was fully acknowledged and appreciated (Mika Sato, 2006).

In the recent years clustering has undergone a substantial metamorphosis. From ›eing an exclusively *data* driven pursuit, it has transformed itself into a vehicle whose data ·entricity has been substantially augmented by the incorporation of domain knowledge thus ;iving rise to the next generation of *knowledge*-oriented and *collaborative* clustering. Related to these, the fuzzy clustering is used.

After distribution centre are defined there is a need of Travelling Salesperson 'roblem (TSP) to distribute the product to the markets. In the TSP, the goal is to find the ·hortest distance between *N* traveling points. The number of possible route for an *N* city tour ·equires *N*! additions. An exhaustive search through all possible paths is acceptable only ·hen *N* is small. As *N* increases, the number of possible path grows geometrically. A 20-:ity tour involves 2.43 x 1018 additions. Even with 1 billion additions performed in 1 ·econd, this would take over 1852 years. Adding one more city would cause the number of ıdditions to increase by a factor of 21. Obviously, exhaustive search becomes impractical.

So, to make it more quickly and simply, genetic algorithm is necessary to used for ·aving the time. Genetic Algorithm (GA) is a method for solving optimization problem that based on evolutionary theory in biology. This algorithm work with a population of candidate solutions named as chromosome that initially generated randomly from the area of the solution space of objective function. By using a mechanism of genetic operator i.e. crossover and mutation the population is evolutes controlled by fitness function that directed to convergence condition (Widyastuti and Hamzah, 2007).

This paper presents the application of GA approach in this cluster market of routing transportation problem called TSP. Although GA probably will not lead to the best solution, it can find a near optimal solution in a much less time (within several minutes).

LITERATURE REVIEW

Fuzzy C-Means (FCM)

The fuzzy c-means (FCM) algorithm (Bezdek, 1981) is one of the most widely used methods in fuzzy clustering. Data clustering is the process of dividing data elements into classes or clusters so that items in the same class are as similar as possible, and items in different classes are as dissimilar as possible. Depending on the nature of the data and the purpose for which clustering is being used, different measures of similarity may be used to place items into classes, where the similarity measure controls how the clusters are formed. Some examples of measures that can be used as in clustering include distance, connectivity, and intensity.

There are two clustering namely hard and soft. In hard clustering, data is divided into distinct clusters, where each data element belongs to exactly one cluster. In fuzzy clustering (also referred to as soft clustering), data elements can belong to more than one cluster, and associated with each element is a set of membership levels. These indicate the strength of the association between that data element and a particular cluster. Fuzzy clustering is a process of assigning these membership levels, and then using them to assign data elements to one or more clusters.

The FCM algorithm attempts to partition a finite collection of n elements $X = \{x_1, \ldots, x_n\}$ into a collection of c fuzzy clusters with respect to some given criterion. Given a finite set of data, the algorithm returns a list of c cluster centre $C = \{c_1, \ldots, c_c\}$ and a partition matrix $U = u_{i,j} \in [0,1],\ i = 1, \ldots, n,\ j = 1, \ldots, c$, where each element u_{ij} tells the degree to which element x_i belongs to cluster c_j. Like the k-means algorithm, the FCM aims to minimize an objective function. The standard function is:

$$u_k(x) = \frac{1}{\sum_j \left(\frac{d(\text{center}_k, x)}{d(\text{center}_j, x)} \right)^{2/(m-1)}}.$$

which differs from the k-means objective function by the addition of the membership values u_{ij} and the fuzzifier m. The fuzzifier m determines the level of cluster fuzziness. A large m results in smaller memberships u_{ij} and hence, fuzzier clusters. In the limit m = 1, the memberships u_{ij} converge to 0 or 1, which implies a crisp partitioning. In the absence of experimentation or domain knowledge, m is commonly set to 2. The basic FCM Algorithm, given n data points (x1, . . ., xn) to be clustered, a number of c clusters with (c1, . . ., cc) the center of the clusters, and m the level of cluster fuzziness.

In fuzzy clustering, each point has a degree of belonging to clusters, as in fuzzy logic, rather than belonging completely to just one cluster. Thus, points on the edge of a cluster, may be *in the cluster* to a lesser degree than points in the center of cluster. An overview and comparison of different fuzzy clustering algorithms is available.

Any point x has a set of coefficients giving the degree of being in the kth cluster $w_k(x)$. With fuzzy c-means, the centroid of a cluster is the mean of all points, weighted by their degree of belonging to the cluster:

$$c_k = \frac{\sum_x w_k(x) x}{\sum_x w_k(x)}.$$

The degree of belonging, $w_k(x)$, is related inversely to the distance from x to the cluster center as calculated on the previous pass. It also depends on a parameter m that controls how much weight is given to the closest center. The fuzzy c-means algorithm is very similar to the k-means algorithm.

Choose a number of clusters. Assign randomly to each point coefficients for being in the clusters. Repeat until the algorithm has converged (that is, the coefficients' change between two iterations is no more than ε, the given sensitivity threshold).

Compute the centroid for each cluster, using the formula above. For each point, compute its coefficients of being in the clusters, using the formula above. The algorithm minimizes intra-cluster variance as well, but has the same problems as k-means; the minimum is a local minimum, and the results depend on the initial choice of weights.

The expectation-maximization algorithm is a more statistically formalized method which includes some of these ideas: partial membership in classes. Fuzzy c-means has been a very important tool for image processing in clustering objects in an image. In the 70's,

nathematicians introduced the spatial term into the FCM algorithm to improve the accuracy of clustering under noise.

Cluster Analysis

Cluster analysis or clustering is the task of assigning a set of objects into groups called clusters) so that the objects in the same cluster are more similar (in some sense or another) to each other than to those in other clusters.

Clustering is a main task of explorative data mining, and a common technique for statistical data analysis used in many fields, including machine learning, pattern recognition, image analysis, information retrieval, and bioinformatics.

Cluster analysis itself is not one specific algorithm, but the general task to be solved. It can be achieved by various algorithms that differ significantly in their notion of what constitutes a cluster and how to efficiently find them. Popular notions of clusters include groups with low distances among the cluster members, dense areas of the data space, intervals or particular statistical distributions. Clustering can therefore be formulated as a multi-objective optimization problem. The appropriate clustering algorithm and parameter settings (including values such as the distance function to use, a density threshold or the number of expected clusters) depend on the individual data set and intended use of the results. Cluster analysis as such is not an automatic task, but an iterative process of knowledge discovery or interactive multi-objective optimization that involves trial and failure. It will often be necessary to modify preprocessing and parameters until the result achieves the desired properties.

Besides the term *clustering*, there are a number of terms with similar meanings, including *automatic classification*, *numerical taxonomy*, *botryology* (from Greek βότρυς "grape") and *typological analysis*. The subtle differences are often in the usage of the results: while in data mining, the resulting groups are the matter of interest, in automatic classification primarily their discriminative power is of interest. This often leads to misunderstandings between researchers coming from the fields of data mining and machine learning, since they use the same terms and often the same algorithms, but have different goals.

Center of Cluster

n centroid-based clustering, clusters are represented by a central vector, which may not necessarily be a member of the data set. When the number of clusters is fixed to k, k-means clustering gives a formal definition as an optimization problem: find the k cluster centers and assign the objects to the nearest cluster center, such that the squared distances from the cluster are minimized.

The optimization problem itself is known to be NP-hard, and thus the common approach is to search only for approximate solutions. A particularly well known approximative method is Lloyd's algorithm, often actually referred to as "*k-means algorithm*". It does however only find a local optimum, and is commonly run multiple times with different random initializations. Variations of k-means often include such optimizations as choosing the best of multiple runs, but also restricting the centroids to members of the data set (k-medoids), choosing medians (k-medians clustering), choosing the initial centers less randomly (K-means++) or allowing a fuzzy cluster assignment (Fuzzy c-means).

Most k-means-type algorithms require the number of clusters-k-to be specified in advance, which is considered to be one of the biggest drawbacks of these algorithms. Furthermore, the algorithms prefer clusters of approximately similar size, as they will always assign an object to the nearest centroid. This often leads to incorrectly cut borders in between of clusters (which is not surprising, as the algorithm optimized cluster centers, not cluster borders).

K-means has a number of interesting theoretical properties. On one hand, it partitions the data space into a structure known as Voronoi diagram. On the other hand, it is conceptually close to nearest neighbor classification and as such popular in machine learning. Third, it can be seen as a variation of model based classification, and Lloyd's algorithm as a variation of the Expectation-maximization algorithm for this model discussed below.

Traveling Salesperson Problem

The idea of the travelling salesman problem (TSP) is to find a tour of a given number of cities, visiting each city exactly once and returning to the starting city where the length of this tour is minimized. The first instance of the travelling salesman problem was from Euler in 1759 whose problem was to move a knight to every position on a chess board exactly once (Michalewicz, 1994).

Travelling Salesperson Problem (TSP) is one of the issues combinatorial optimization, if there are a number of cities (or place) and the cost of travel from one city to other cities. Description of the problem is how to find the cheaper route of visit all the cities, each the city is only visited once, and must back to the original departure city. The combination of all existing route is the factorial number of cities. Travel cost can be a distance, time, fuel, convenience, and so forth.

Genetic Algorithm

Genetic algorithms are search techniques and optimization which is inspired by the principles of genetics and natural selection (Darwin's theory of evolution). This algorithm is used to obtain the exact solution for the optimization problem of a single variable or multi variable.

GA is a general purpose guided random search that based on the natural selection principles of biological evolution to improve the potential solutions. GA includes random elements which help to prevent the search begin trapped in local minimum. These properties overcome some of the short comings of conventional optimization approaches in ill-structured problems (Can and Rad, 2002).

Being inherently parallel, GA is performed over a population of solution candidates. The manipulation process uses genetic operators to produce a new population of individuals (offspring) by manipulation the solution candidates. The algorithms start working by evaluating thousands of scenarios automatically until they find an optimal answer. The genetic algorithms bias the selection of chromosomes so that those with the better fitness functions tend to reproduce more often than those with worse evaluations.

Given an optimisation problem, GA first encodes the parameters into solution candidates. In the initial phase, the population consists of randomly enervated heterogeneous solution candidates. After all chromosomes go through evaluation process, an initial population will improve as parents are replaced by better and better children. The best individual in the final population can be a highly evolved solution to the problem.

According to Briant and Arthur (2000), the genetic algorithm process generally consists of the following steps i.e.: encoding, evaluation, crossover, mutation, and decoding.

MATERIALS AND METHODS

Fuzzy clustering is one method which can capture the uncertainty situation of real data and it is well known that fuzzy clustering can obtain a robust result as compared with conventional hard clustering (Sato, 2006). Following the emphasis on the general problem of data analysis, which is a solution able to analyze a huge amount of complex data, the merit of fuzzy clustering is then presented.

After cluster was constructed, next step is to design routing from centre of cluster to the members. The members and the cluster are traditional market in Jakarta, Indonesia. Routing is designed by Transportation Salesperson Problem and Genetic Algorithm is used to make optimization. The methodology framework is shown on Figure 3.

RESULTS AND DISCUSSION

There is a great interest in clustering techniques due to the vast amount of data generated in every field including business, health sciences, engineering and aerospace. It is essential to extract useful information from the data. Clustering techniques are widely used in pattern recognition and related applications. This research monograph presents the clusters for traditional market in Jakarta, which these have each distribution centre.

Identify Parameter for Grouping

Clustering of traditional market in Jakarta is constructed by 4 parameters combining. These are latitude position, longitude position, density of traders at the markets and accessibility of 153 transitional markets.

Clustering to Define Centre of Distribution

Centre of distribution of traditional market in Jakarta is defined by fuzzy clustering. we use MATHLAB to create the clustering. Fuzzy clustering with c-means is used for data analysis. The algorithm of fuzzy c-means (FCM) are below :

1. Input data to be in the cluster is a matrix of n x m (n = number of data sample, m-atribute for each data). X_{ij} = sample data to i (i = 1,2,...,n), attribute to-j (j=1,2,...,m).
   Number of cluster (c) = 15
   Square (w) = 2
   Maximum iteration (maxIter) = 100
   Error (ℓ) = 10^{-5}
   First objective function (P_0) = 0
   First iteration (t) = 1
2. Random number (μ_{ik}) generated,
   i = 1,2,...,n; k = 1,2,...,c; with sequence below.
   $Q_j \sum_k^c$
   j = 1,2,...,m
   which are,
   $$\mu_{ik} = \frac{\mu_{ik}}{Q_j}$$
3. Center of cluster to-k ; with k = 1,2,...,c; and j = 1,2,...,m
   $$V_{kj} = \frac{\sum_{i=1}^{n}((\mu_{ik})}{\sum_{i=1}^{n}(\mu_i}$$

4. Objective fungsion at iteration to-t, P_t :
   $$P_c = \sum_{i-1}^{n}\sum_{k=1}^{c}\left(\left[\sum_{j-1}^{m}(X_{ij} - V_{kj})^2\right](\mu$$
5. Partition matrix change
   $$\mu_{ik} = \frac{\left[\sum_{j=1}^{m}(X_{ij} - V_{kj})^2\right]^{\frac{-1}{w-1}}}{\sum_{k=1}^{c}\left[\sum_{j=1}^{m}(X_{ij} - V_{kj})^2\right]^{\frac{-1}{w-1}}}$$
   i = 1,2,...,n ; and k = 1,2,...,c
6. Finish iteration
   If : $(|P_t - P_{t-1}$ or $(t > Ma)$ so iteration is stoping.;
   If not t = t+1, looping go to 3.

Clustering of numerical data forms the basis of many classification and system modelling algorithms. The purpose of clustering is to identify natural groupings of data from a large data set to produce a concise representation of a system's behaviour.

Fuzzy Logic Toolbox tools allow to find clusters in input-output training data. It can use the cluster information to generate a Sugeno-type fuzzy inference system that best models the data behaviour using a minimum number of rules. The rules partition themselves according to the fuzzy qualities associated with each of the data clusters. the command-line function is using, genfis2 to automatically accomplish this type of FIS generation.

Quasi-random two-dimensional data is used to illustrate how FCM clustering works. To load the data set and plot it, type the following commands:

```
load sheet1.dat
plot(sheet1 (:,1), sheet1 (:,2),'o')
```

Next, invoke the command-line function fcm to find two clusters in this data set until the objective function is no longer decreasing much at all.

```
[center,U,objFcn] = fcm(sheet1sheet1,15);
```

Here, the variable centre contains the coordinates of the fifteen cluster centres, U contains the membership grades for each of the data points, and obj Fcn contains a history of the objective function across the iterations.

The fcm function is an iteration loop built on top of the following routines:

- initfcm — initializes the problem
- distfcm — performs Euclidean distance calculation
- stepfcm — performs one iteration of clustering

To view the progress of the clustering, plot the objective function by typing the following commands:

```
figure
plot(objFcn)
title('Objective Function Values')
xlabel('Iteration Count')
ylabel('Objective Function Value')
```

Figure of convergency is presented by fig. 4.

Finally, plot the fifteen cluster centres found by the fcm function using the following code:

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i = 1,2,...,n ; and k = 1,2,...,c

6. Finish iteration

If : ($|P_c - P_{c-1}$ or (t > Ma) so iteration is stoping.;

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Figure of convergency is presented by fig. 4.

Finally, plot the fifteen cluster centres found by the fcm function using the following code:


```
maxU = max(U);
index1 = find(U(1, :) == maxU);
index2 = find(U(2, :) == maxU);
figure
line(fcmdata(index1, 1), fcmdata(index1, 2), 'linestyle',...
'none','marker', 'o','color','g');
line(fcmdata(index2,1),fcmdata(index2,2),'linestyle',...
'none','marker', 'x','color','r');
hold on
plot(center(1,1),center(1,2),'ko','markersize',15,'LineWidth',2)
plot(center(2,1),center(2,2),'kx','markersize',15,'LineWidth',2)
```

Coordinate geographic centre of each cluster is presented by table 2.

Mapping Distribution Centre by Fuzzy Clustering

The 15 cluster traditional market in Jakarta was defined. The centres of cluster are presentend with different colour. One of them will be presented by fig. 5.

Routing with Transportation Salesperson Problem-Genetic Algorithms.

The TSP is a standard problem in optimization. The objective in this paper is to minimize the travelling distance of *N* cities in a 10 km square radius from (0,0). Figure 3 for cluster 1 which colour is yellow shows a 8-city tour starting from green dot (Kramat Jati) colour which is the centre to 7-others cities in the 10 km square radius, where the yellow dots are indicates the city needed to be travelled.

Fig. 7 describes the flow of the optimization of TSP by GA. GA first encodes the travelling cities into chromosome. The population size is 1. After the chromosome goes through evaluation process, a fitness value is assigned to the chromosome. The child is then compared with the parent. If it is fitter than the parent, it will replace the parent, or it will not be used. Then the parent will reproduce a child through neighbourhood mutation (which will be discussed in part v in this section). The process repeats until it reaches the maximum number of generations. The chromosome in the final population is a highly evolved solution to the problem.

Coding

In GA, the parameters to be optimized are encoded into chromosomes (Figure 8) and each chromosome is a solution candidate. The encoding scheme depends on the nature of parameters to be optimized. In this problem, each city going to be visited is represented by an integer. The chromosome *S*, is a sequence of integers, can be formed by encoding the list of cities in the order they are visited. The length of chromosome equals to *N*.

Initialization

In this problem, we set the population size equals to 1 and the initial populationis randomly generated.

Evaluation

In the evaluation module, each chromosome is coded with the integer of the cities to be travelled and the travelling time is calculated. The fitness value, calculated according to the fitness function, which is defined by the designer, is assigned to the chromosome.

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index1 = find(U(1, :) == maxU);
index2 = find(U(2, :) == maxU);
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'none','marker', 'o','color','g');
line(fcmdata(index2,1),fcmdata(index2,2),'linestyle',...
'none','marker', 'x','color','r');
hold on
plot(center(1,1),center(1,2),'ko','markersize',15,'LineWidth',2)
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In the evaluation module, each chromosome is coded with the integer of the cities to be travelled and the travelling time is calculated. The fitness value, calculated according to the fitness function, which is defined by the designer, is assigned to the chromosome.

Reproduction and Generation Selection

The reproduction module selects the alleles to be mutated. Then a new child chromosome is produced. The new chromosome is compared with parent chromosome. Elitism is used in the generation selection. If the new chromosome fitter than the parent, then it replaces the parent, else it will not be used. This avoids the loss of potential candidates by copying the best member into the succeeding generation.

Neighbourhood Mutations

Conventional crossover and mutation are the most commonly used operations in GA to obtain offspring. However, simple crossover and mutation may lead to violation of the constraint of TSP, as the city to be travelled may be missed or duplicated. As shown in Figure 5, the crossover operation will not work. Let's say, we have a 2nd crossover point. Every number in parent 1 before the crossover point is copied into the same position in child 1. Then, every number after the crossover point in parent 2 is put into child 1. The opposite is done for child 2.

After the crossover operation, in Child 1, the city 1 is visited twice and city 8 is missed. The reproduction should preserve all the cities required in the chromosomes from the parents to the children. A different approach has therefore been adopted to the reproduction of chromosomes. Ho and Yeung (2000), A neighbourhood is defined for the best chromosome in a generation and the chromosome only evolves to one of its neighbours.

The choice of chromosomes for the initial generation plays a vital role in the convergence toward the optimal solution. In order to smooth out this effect, 20tests have been carried out for each traffic condition with each neighbourhood definition. In each test, the chromosomes of the initial generation are selected randomly from the set of possible sequences. The average of the minimum crossover the 20 tests is then calculated. All the simulation runs are performed on MATHLAB. Figure 7 summarizes the average travelling distance (of 20 tests) of 8 cities over 100 generations for different neighbourhood mutations.

The following pseudo-code that is created for solve the above problems with the TSP using genetic algorithms:

```
function Fitness (Kromosom[i])→integer
{calculate the fitness value of eachchromosome}
Declaration
Jum : integer
j : integer
Chromosome[] : array of integer of integer
Distance function (input A, B : integer) → integer
{generate the distance between two cities A and B }
Algorithm
Jum ←Jarak(A,Kromosom[i][1])
for j ←2 to 4 do
Jum →Jum +
Distance (chromosome[i][j-1], chromosome [i][j])
endfor
Jum ← sum + Jarak(Kromosom[i][4],A)
→ Jum
Crossover procedure (input populasi: integer, pc:real)
{parent selection on the cross over }
```

Declaration

k : integer
R[] : array of integer
function random (input a-b :
integer) → nteger
/generates random numbers from a number to b /

Algorithm

k= 0
While k <= populasi do
R[k] ← random(0-1)
if R[k] < pc then
pilih Kromosom[k][]sebagai induk
endif
k←k+1
endwhile
function of Number mutations (input JumGen,
JumlahKromosom: integer, pm: real) →integer
/count the number ofthemutations /

Declaration

TotalGen : integer
JumMutasi : integer

Algorithm

TotalGen ←JumGen * JumlahKromosom
pm ←0.2
JumMutasi ←0.2*TotalGen
→JumMutasi

CONCLUSION

Existing traditional market is very important to help Jakarta's people life. They go to traditional market everyday to buy many things for basic need consumption. Availability of goods and stability of price are important to consider. This paper gives a solution by presenting the distribution centres to facilitate all 153 traditional markets in Jakarta. It should be distribute to 15 clusters. Each cluster has one centre, it could be distribution centre. MATLAB is used to calculate and solve the problem by fuzzy clustering. The iteration to convergence were 27 iteration. Every distribution centre is nearly optimum to distribute the goods to all traditional markets in the cluster.

Genetic algorithms appear to find good solutions for the travelling salesman problem. however it depends very much on the way the problem is encoded and which crossover and mutation methods are used. It seems that the methods that use heuristic information or encode the edges of the tour (such as the matrix representation and crossover) perform the best and give good indications for future work in this area.

Overall, it seems that genetic algorithms have proved suitable for solving the travelling salesperson problem. It seems that the biggest problem with the genetic algorithms devised for the travelling salesperson problem is difficulty to maintain structure from the parent chromosomes and still end up with a legal tour in the child chromosomes.

Perhaps a better crossover or mutation routine that retains structure from the parent chromosomes would give a better solution than we have already found for some travelling salesman problems.

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Tables

Tabel 1. history of the objective function across the iterations

ITERATION	FCN
Iteration count = 1	obj. fcn = 0.041209
Iteration count = 2	obj. fcn = 0.030768
Iteration count = 3	obj. fcn = 0.030263
Iteration count = 4	obj. fcn = 0/029399
Iteration count = 5	obj. fcn = 0.027972
Iteration count = 6	obj. fcn = 0.026048
Iteration count = 7	obj. fcn = 0.024263
Iteration count = 8	obj. fcn = 0.022998
Iteration count = 9	obj. fcn = 0.021964
Iteration count = 10	obj. fcn = 0.021105
Iteration count = 11	obj. fcn = 0.020507
Iteration count = 12	obj. fcn = 0.020139
Iteration count = 13	obj. fcn = 0.019853
Iteration count = 14	obj. fcn = 0.019580
Iteration count = 15	obj. fcn = 0.019307
Iteration count = 16	obj. fcn = 0.019042
Iteration count = 17	obj. fcn = 0.019042
Iteration count = 18	obj. fcn = 0.018506
Iteration count = 19	obj. fcn = 0.019042
Iteration count = 20	obj. fcn = 0.018366
Iteration count = 21	obj. fcn = 0.018337
Iteration count = 22	obj. fcn = 0.018313
Iteration count = 23	obj. fcn = 0.018292
Iteration count = 24	obj. fcn = 0.018275
Iteration count = 25	obj. fcn = 0.018262
Iteration count = 26	obj. fcn = 0.018251
Iteration count = 27	obj. fcn = 0.018242

Table 2. Coordinate geographic centre of each cluster

No.	Latitude	Longitude
1	6.166.857	1.065.258
2	6.117.264	1.065.397
3	6.097.971	1.065.185
4	6.113.407	1.064.485
5	6.132.045	1.065.233
6	608.422	1.064.826
7	6.198.298	1.065.389
8	6.177.212	1.065.032
9	6.112.826	106.504
10	614.756	1.064.774
11	6.090.052	1.064.985
12	6.111.806	1.064.832
13	6.075.793	1.065.701
14	6.151.379	1.065.046
15	6.085.015	1.064.342

Figures

Fig. 1. Region of Jakarta Map

Fig. 2. Traditional markets in Jakarta

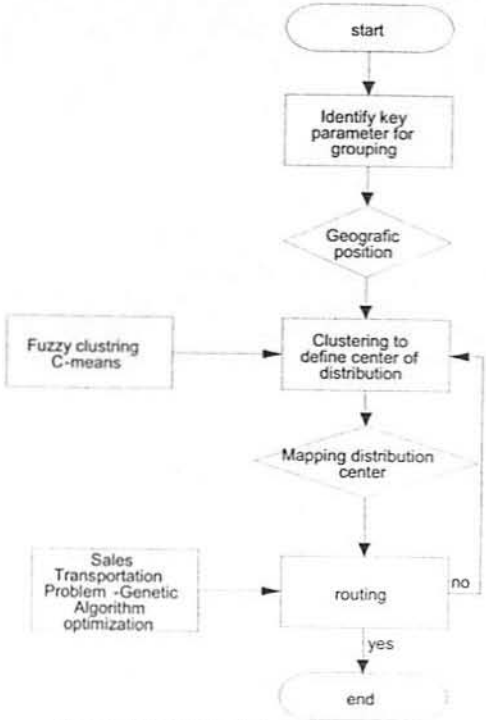

Fig. 3. The Methodology Framework

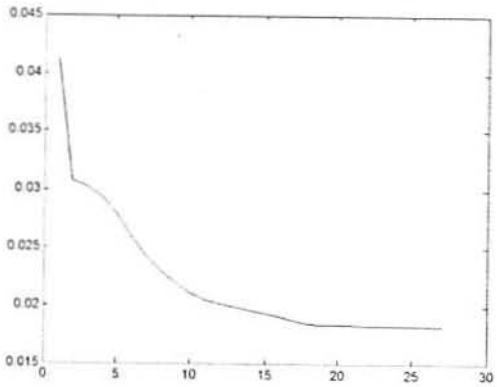

Fig. 4 : Convergency Iteration

Fig. 5. Cluster 1, 2, and 3.

Fig. 6. Cluster 3.

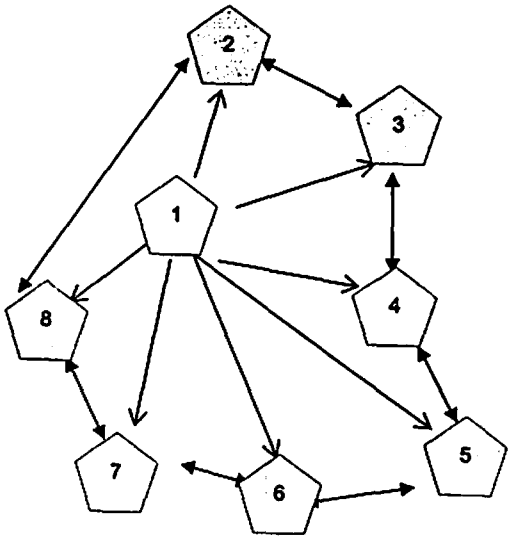

Fig. 7. Cluster one as a sample for routing TSP

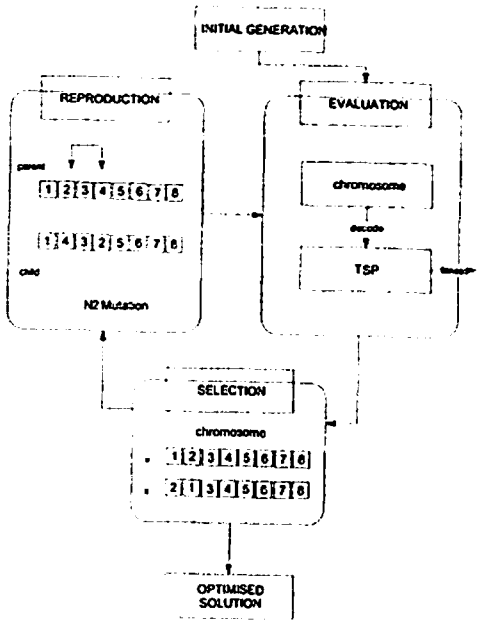

Fig. 8. Mechanisms of the proposed algorithms

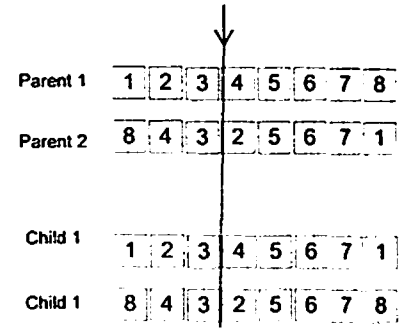

Fig. 9. Crossover of chromosome

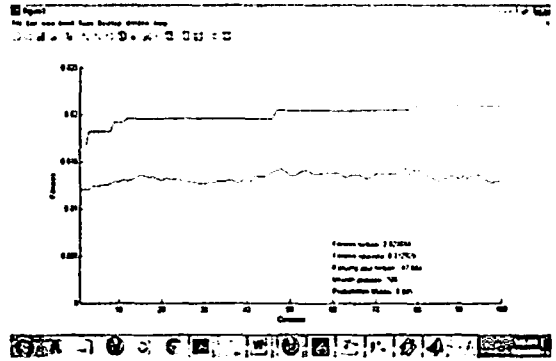

Fig. 10. The average travelling distance (of 20 tests) of 8 cities over 100 generations.

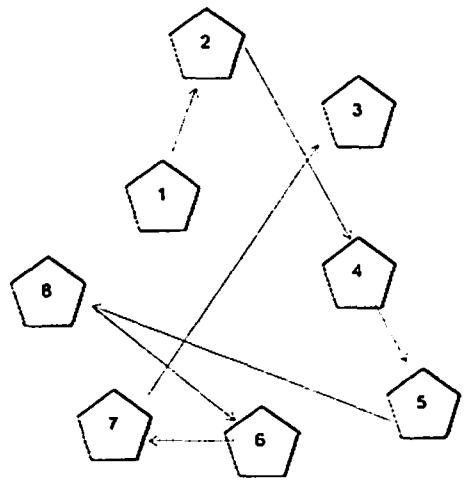

Fig. 11. Sample optimum routing of 8 cities from distribution centre (1) to seven other cities.