



LEAST AND UNIQUE PRICE AUCTION WITH ASCENDING SLICES (LUP-AS): PLAYING GAME STYLE ONLINE-AUCTION

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ABSTRACT

In last two decades, Online (Web) auctions and its types took a lot of attention by researchers and business corporates. The main problem in many auction types is the fixed-closing time, which causes a phenomenon called "sniping" (i.e. submitting a bid at the final moments by one of the bidders). This paper resolved this problem by presenting a proposed type of online auctions called Least and Unique Price with Ascending Slices (LUP-AS) which is an enhanced version of LUP [6][7]. In the LUP-AS, the item price will be collected by the bidding processes. During the auction life there will be many temporary winners (who submit the least and unique price). However, the winner in this auction has to submit the least, unique but his price must be greater than the number of cancelled bids. The number of cancelled bid is a counter incremented by one when a bidder submit a least but not unique price during the auction life. The main advantages of LUP-AS are: Funny (like playing game), semi-sealed, dynamic (no fixed closing time and discard the snipers), the winner pay a very least price for item, and the seller gets the fair price. An implementation of LUP-AS uses an Artificial Neural Network in order to provide the administrators the ability to classify the bidders into groups to distribute special benefits according to each group.

Keywords: *Online Auction, Bidders, Descending Bid, Sealed Bid, Acceptable Price.*

1. INTRODUCTION

Yearly, huge number of Internet goers doing their transactions via online auctions. This is a normal result according to the increasing publicity of the Internet use, e-commerce, and its revenue modes. Business corporates accompanied with the governmental agencies are ardent to discover approaches of poignant assigning their resources by utilizing different types of auction mechanisms [4]. Several types of auction were used on the market and in the Internet such as: the Dutch auction Limbo, Unique auction, English auction, Second price sealed bid (aka. Vickery).

Klarreich in [3] showed that "Anyone who has bid in more than a handful of eBay online auctions has probably run into the phenomenon called (sniping), in which bidders place their bids in the last few seconds of an auction, leaving rivals no time to respond". As a result, many of bidders could be frustrated and there is a great chance that they will leave without return to the auction in the future.

According Barnes and Vidgen in [1], online auction is one of the most influx in business.

Developers for any new auction type try to put mechanisms to dishearten party, entry-preventing, ravenous conduct, in addition to block unfair item pricing and many other issues. Even though there are many solutions for these problems. Despite many solutions for these issues and problems were proposed and resolved separately. Yet, there is no auction type implies a mechanism(s) associated with in order to resolve all of these issues. In Least and Unique Price LUP auction [7], most of the issues associated with many auction types such as sniping were resolved. It attracts the internet users (especially the teenager) who love the betting, because they grew up to play the online games. Unlike, LUP has a new type of sniper who puts periodically the least price and waits the luck to be the winner. Moreover, there was a serious problem with LUP which is "Who will be the first bidder?", because he will lose his first bid price. The aim of this paper is to present and propose an enhanced version of LUP auction by overcome these problems and remains the attractive features of LUP auction as is.



General Auction types:

Auctions types could be categorized based on many factors such as: How the winner will be selected, style of bids submission, the paid price by the winner for the item. The types of electronic or traditional auctions are: English, Dutch, Sealed bid, Common value/objective value, First price, Second price auction, and Private value. There common and well know auctions are:

1. English Auction:

English auction is an ascending-price and public. The bidding starts by the auctioneer with a very low price of the item being auctioned. The submitted bid by the participants are increasing until no more bids are submitted or some predefined criteria being matched such as the closing date/time. When the auction is closed, then the bidder who submits the highest price during the auction life will be the winner. Such type of auction is a well-known type and is widely used in specific cases such as real estate [5].

2. Dutch Auction:

It is another auction style where the bidding process is a descending (i.e. the submitted bid prices are decreasing rather than increasing). In a Dutch auction [8], the owner of the item gradually decreased offered price until one of the bidders (the first one) accepts the offered price and the auction will be closed after this event. So, every Dutch auction being done has a single interactive seller/bidder who is the first bidder accepted the offered price.

3. Vickrey Auction:

Vickrey auction [9] is not a public (sealed bid) and it has another name which a second price auction. The bidders are submitting their prices in secret envelopes. The winner in such auctions is the bidder who submits the highest price. However, he will pay amount corresponds to the second highest bid.

4. Continuous Double Auction:

A Continuous Double Auction (CDA) is mostly used in the stock market like the New York Stock Exchange (NYSE). In such auctions, there are many bidders (act as buyers) and sellers that are infinitely bargaining a single item. CDA is normally an open auction. The bids submitted by two parties are matched and settled during the auction life time based on rules of the auction [10].

5. Limbo Auction (www.41414.com):

The bidders initialize their online bid like a playing on their cell phones. The main disadvantage of Limbo that it is only works only on the some of the mobile network operators in U.S.A. So, the bidder needs to be a member of the Limbo folk by having a mobile phone on specific mobile network operators in order to play and share their text messaging revenue with Limbo

6. Unique Auction (www.UniqueAuction.com):

It is an online auction equipping occasion for peer-to-peer bidding to gather items from confidence provenance. This auction is secret and bid price with fractions is allowed. In this auction the maximum bid price for the items must be less than 20% of the market price. For instance, an item with market price of \$500 could be sold with only \$100 as a maximum won price. The Unique site guarantees that all submitted bids cannot surpass \$100 which treats as a threshold value. The unique and highest bid price under \$100 will win. Every placed bid requires a participating cost of \$1 for Unique auction members and \$2 for non-members. There two cases to close the auction: when the auction duration life time is elapsed or when the number of submitted bids is equal to the amount of reserved price. So, every item has its specific number of bids which needs to be met before announcing the final winner.

2. LEAST AND UNIQUE PRICE AUCTION (LUP)

LUP is presented in [7] and widely and practically implemented in [6], the main idea of these researches is that the final winner in this auction is the bidder who submitted the least and unique price when the auction being closed. During the auction life, there will be many temporary winners and the auction will be closed when the number of submitted bids is equal to market price of the item. All the bidding processes are evaluated and could be accepted online by showing the bidder name only as the current winner (if the bid price is least and unique) on the screen. Thus, the bidders can see the current or final winner name without knowing his submitted price. The steps of LUP auction are presented in figure 1 which shows the sequence of the LUP auction.

Figure 1. Flow Chart Of LUP Algorithm
(IN APPENDIX B-1)



The main advantage of the LUP auction is its ability to resolve most of the problems (such as sniping) associated with the well-known auction types. It is a descending bidding price auction, because the participants submit their bid prices as the item price is decreasing. This auction is considered as a semi-sealed auction, because only the current winner name is will display for the others, without display his submitted price.

However, LUP has a major problem with new type of sniper who puts periodically the least price (which is one dollar each time he participates) and waits the luck to be the winner. The second problem which is a serious problem with LUP is that the first participant will lose his first bid price.

3. LEAST AND UNIQUE PRICE WITH ASCENDING SLICES AUCTION (LUP-AS)

This section presents the proposed auction algorithm which is an enhanced version of LUP auction which already described in the previous section. The main objective of the proposed auction (LUP-AS) is to optimize the LUP by solving all of its related problems. Most of online auctions can be considered as Forward or Reverse auctions. Forward auction is an auction to sell, while in the Reverse auction the participants try to buy [2], LUP-AS can be classified as Forward auction.

A. How Does LUP-AS Auction works?

The bidder in LUP-AS auction has to have an account in the website to be a member. The account must be charged with an enough amount of money in order to participate. The member (i.e. the buyer) can participate in any open auction. The seller, who wants to announce his item on LUP-AS to be sold in an auction, can fill a form and determines the acceptable price (which normally equal to the market price based on the LUP-AS policy). Once the seller activates his auction, then it will be lunched and started online. Bids are placed by the members, and result of their bids (accepted or not) immediately on the auction web-page. If the submitted bid is accepted, then only the bidder name as a current winner will be displayed (the submitted bid is hidden and only it saves into the database). The main attractive feature of LUP-AS is the closing condition. In the proposed auction, the price of the item being auction is collecting via the bidding fees (where the bidder's account will be decreased by 1\$ for each submitted price). The

auction is closed when the number of submitted bids with the last, least, and unique price is greater or equal to the market price. This closing condition enables the seller to get the full item price (i.e. its market value). At other side, the final winner pays a very low price. He will be the total amount equals to his least and unique price plus the number of bids submitted by him. For example, he may pay 8\$ (he participates 3 times and his least and unique price is 5\$) for the item with 100\$ (the remaining amount 92\$ will be collection from the other bidder as fees for each submitted bid by them). Figure 2 show the main steps of the proposed auction.

Figure 2. Flow Chart Of LUP-AS Algorithm
(IN APPENDIX B-2)

As seen LUP-AS is very similar to LUP auction, the added steps of LUP-AS are dashed lines. The parameter NumberOfCancelledBids is used to solve the main problem with LUP. This parameter forces the bidder to increase his bid price because his bid must be greater than the value of this parameter. In other words, the bidder cannot submit one dollar as bid price every time (as in LUP); because the NumberOfCancelledBids will be incremented each time a least price is duplicated.

B. The LUP-AS Steps:

The following steps show the workflow of LUP-AS auction in details:

1. The seller announces his item for sale by filling all information such as determining the acceptable price which is normally equals to the market or retail price.
2. The item will be published for bidding on the LUP-AS auction, once the seller activates its auction.
3. Two important variables current WinnerName and the WinnerBid are set the following initial values: Null and the item market price respectively (which is the maximum possible value for the item). In other words, to enable the first bidder the current winner and his bid price will the least by default.
4. Set the AMOUNT of this item to Zero (The amount is the accumulative summation of the biding fees that will be collected from all bidders -during the auction time- plus the winning bid).
5. Set the NumberOfCancelledBids to Zero. The aim of this parameter is mitigates the effects of



- the new type of snipers as seen in the classical LUP auction, and to minimize the lucky bidders as much as possible.
6. Receive a new bid by typing the bidder name with his bid into the bidding webpage. One dollar will be discounted from the bidder's account for every bidding process as fees (or half dollar will be fees if a golden member the LUP-AS is the bidder?). Note: bids with cents are not allowed.
 7. If the balance of the bidder is greater than or equal to the number of bids submitted by him plus the submitted current bid Then go to step 8 Else an error message will be shown to the bidder with an explanation of why his bid was rejected. In this case the bidder can charge his account balance.
 8. The variable *AMOUNT* will be incremented by one dollar for each bidding process (or half dollar with each golden member).
 9. For settlement purposes, the bidder name and his bid are saving in the database.
 10. If the submitted bid is least Then go to step 11 Else go to step 6. Least: means that the submitted price is less than or equal to the current winner price and is greater than the number of cancelled bids at the same time,
 11. If the submitted bid by the bidder is least but not Unique Then the execution will go to the steps 12 and 13, Else go to step 14.
 12. Reset the WinnerName to Null (because the least unique price is replicated).
 13. Increment the NumberOfCancelledBids by One. Then go to step 6.
 14. If the submitted bid is less than or equal to the NumberOfCancelledBids Then go to step 15 Else go to step 16.
 15. An error message will be displayed for the bidder to inform and ask him to increase his bid. Then go to step 6.
 16. Only the current bidder name is published at the website as the current winner. This bidder will be current winner, because his bid is least, unique, and greater than the NumberOfCancelledBids.
 17. If (the amount + Current submitted bid \geq the acceptable price) Then an auction will be closed Else go to step 6.

When the LUP-AS auction is closed, the winner is the bidder who offers the last, least, and unique price. However, his price must be greater than the NumberOfCancelledBids. Generally, the winner will pay the last bid price plus the number of bidding that submitted by him during the auction life. At other side, every bidder participated in the auction will loss from his account an amount equals to the number of his biddings (such information are retrieved from the database). Under these Circumstances, LUP-AS auction is designed to maximize the predictable revenue for the sellers and minimize the cost for the winner as much as possible.

Additional advantage of the LUP-AS auction is the snipers are vanished. The main cause of this advantage is lack information about the closing time of the auction. Even, the new type of the snipers in LUP is handled by preventing the bidder to submit one dollar every time, because his price must be greater than TheNumberOfCancelledBids which always increasing. The duration life of LUP-AS auction is ambiguous, it could be minutes or just couples of seconds. Moreover, each bidder should follow a specific a strategy and try many times to participate in the auction and the proposed auction minimizes the luck.

C. Notes about LUP Auction:

The LUP-AS auction needs some skill from the participants to choose the lesser bid that would have the minimum number of occurrences, in addition to little luck. The LUP-AS auction will be more attractive when it is performed on costly items like as new houses, lands, etc. However, the bidding fees in such cases will be a huge amount of money (i.e. not only one dollar like the cheap items and it depends of the market price of item). For example, if the item price is 100,000\$, then the bidding fees could be 100\$ or 200\$. The LUP-AS auction can be implemented and utilized companies to deal with their customers by follow a suitable strategy and offer a very cheap items (especially for the winners). For instance, an airline company can install the LUP-AS system on the server found in one halls of the airport, and the passengers can use their devices (Laptops or Smart-Phones) in order to participate to win ticket with a very low price. If the winner already paid for the ticket, the company should refund its price for him. At the end, every bidder must pay for his biddings even the winner.

D. The LUP-AS Auction Scenarios:

A bidder is the winner (current or final) when his bid price is the least, unique, and greater than TheNumberOfCancelledBids. However, there are many other scenarios. So, the submitted bid will follow one of the following eight scenarios:

Table 1. Decision Table of the LUP-AS scenarios
(IN APPENDIX A-1)

These scenarios are as follow:

- (1) Win:
 - Current Winner, if the auction is still open.
 - Final Winner, when the auction is closed (i.e. [the number of submitted bids by all bidders + the current bid price] >= the acceptable price).
- (2) Lose (Remove the name of the current winner, after that the auction will be without winner at this time)
- (3) Lose (He should increase his bid price, because it is less than or equal the NumberOfCancelledBids)

Cases and scenarios from 4 to 8 are rejected and the bidder will lose for one or more of the following reasons:

- Not Least: the bid price is greater than the current winner price.
- Not Unique: the bid price is equal to the current winner price.
- The submitted price is less than or equal to the NumberOfCancelledBids.

4. IMPLEMENTATION OF LUP-AS AUCTION

The LUP-AS Auction website is implemented using ASP.NET, which is provided by Microsoft Corporation. This tool is an appropriate environment to implement such kind of applications, according to its characteristics, while it is a server side implementation tool. The SQL SERVER tool is a very famous, modern Data-Base Management System. It obtains a desired compatibility with ASP.NET with a user-friendly management tool.

The website has many useful interfaces. They are divided into two sides: Admin Side and Client Side. Only the main and essential interface will be described as follow:

User Profile: figure 3 is the user profile page that enables users to manage their accounts. Firstly, the user should enter his username and password, the system checks them with the database, if they are valid, the system fetch the data of the user as shows

in the next figure (if not an error message would be shown to the user).

Figure 3. User Profile Interface
(IN APPENDIX B-3)

As seen the bidder can refilling his account. In the refill account area, user enters the LUP Card Number and password which is issued by the website administrators. The system checks the Card number and password with the database, if there is a match, the system checks if the Card is valid or it has been used before. If it is valid the amount of the card is fetched and added to the user's balance.

Bidding Interface: The bidding interface is the page that implements the LUP algorithm. It needs a logged in by the user (he must be registered), and a selected auction from the search/home page will be displayed. For the selected auction, the bidding page loads most of its information, the minimum bid amount, the bidding cost, the start date, and the total price are shown directly to the user, other details like description are shown in a separate page that could be accessed through a link, a small image of the item is shown directly, and a full size image could be accessed also through a link. Only the name of the current winner will be shown along with the credit amount of the logged-in user, as in figure 4.

Figure 4. Bidding Interface
(IN APPENDIX B-4)

Placing Bids: when the user types his bid price and clicks the "Enter bid here" button, then the response will be shown immediately to the user based on the algorithm of LUP-AS and will follow one of the above eight scenarios.

Issuing LUP-AS Cards: an administrator can issue LUP-AS Cards with a specific amount ranging from 20 to 500 dollars. When the administrator press the button "Print" the system generates two unique identifiers that are assigned to the Card Number and Password, the Card Number, Password, administrator username, and issue date are stored in the database and printed for selling to users. There is a field in the LUP-AS Cards table in the database called valid, when any card is created, it will be set to true, when the user uses the card it will be set to false.

Artificial Neural Network (ANN) Interface: the administrator can retrain the network as in figure 5 by clicking on the Retrain button using the same redefined patterns or adding some new patterns using the Grid-View to update the output1, and output2 values and commit these new updates. This



action adds the combination input1, input2, input3, input4, and input5 -Updated output1-Updated output2 to the predefined patterns. Now the administrator can retrain the Neural Network using the predefined patterns with some extra patterns that he updated them from this Grid-View.

Figure 5. Ann Page
(IN APPENDIX B-5)

The button Classify picks-up each user from the Database and classify him with the appropriate group relying on a pre-trained Neural Network and shows the administrator the new classifications in groups while Distance is more than 0. The Distance field reflects the comparison between these user's inputs and the predefined pattern's input using the process of the developed NN.

The Characteristics of the Developed Neural Network's:

According to the developed application's complexity the author of this paper decides to implement a Multi-Layer Network, and while the purpose is classifying each user with the appropriate group to attract him by offering him some awards or benefits. The main purpose of the developed NN is to make sure that each user will be classified to which group belongs by analyzing his behaviors and status. So, the Supervised Learning as learning situation is chosen. Obviously the main problem is non-linearly distribution. The Back-Propagation learning is used in batch mode as it is the most popular learning option and faster than other learning if we used the Sigmoidal-Function as activation function.

Neural Network's Patterns:

Inputs: this paper considers some Human Factors which show the behavioral activities of a customer as inputs into our Neural Network. Those behavioral activities are:

1. *Number of won auctions at the end* (This input have to be *minimized* to make the user's group highest). Obviously the winner user (customer) is more satisfied than other user who spends his money trying to win an item and fails at the end.
2. *Number of joined auctions/Making at least one bid in an auction* (This input have to be *maximized* to make the user's group highest). In this input we reward the user who has the highest record in joining auction.
3. *Number of created auctions* (This input have to be *maximized* to make the user's group highest). Succeeded such kind of systems is the system which has more auctions, so our purpose is to

maximize number of active auctions in our web site that's why we encourage the user who made a big number of auctions by considering him belongs to a high ranked group.

4. *Number of biddings* (This input have to be *maximized* to make the user's group highest). More bidding in an auction gives more benefits to the system so this input share the customer with some of these benefits.
5. *High-Price joined auctions/Making at least one bid in such kind of auctions* (This input have to be *maximized* to make the user's group highest). Some auctions offer the web site more incomes than other auctions, so we ranked these auctions as High-Price auctions. That's why we consider the customer who enters in these auctions more important.

This means that a Neural Network will has five input nodes. It can be concluded from above that the proposed Neural Network's inputs are scaled inputs that oscillate on a continuous standard, so the way to accomplish that is to compare each user with others by using this calculation:

Input= $(A(x) - \text{Min}(x)) / (\text{Max}(x) - \text{Min}(x))$
Equation1. Scaling the Input

Where:

- Input is the current users input to the Neural Network.
- $A(x)$ is the user A's input.
- $\text{Min}(x)$ is the minimum of this amount according to all users.
- $\text{Max}(x)$ is the maximum of this amount according to all users.

Another important issue is how to train this Neural Network with continuous scaled inputs while these patterns are infinite and hard to obtain. So, three inputs patterns variance can be considered which are (0, 0.5, 1.0). In other words, each input has three variant opportunities as mentioned: 35 = 243 combinations to train this network with the ability to expand to any other size or architecture.

Outputs: four users' groups are considered.

1. Regular Group (with no benefits) will take the values (0, 0) as output.
2. Silver Group will take the values (1, 0) as output.
3. Golden Group will take the values (0, 1) as output.
4. Diamond Group will take the values (1, 1) as output.

While it is obvious, the proposed Neural Network now will have five input nodes and two output nodes.



By experiments, twelve hidden nodes were used after many trained neural network trying to meet our purpose in fast-enough and minimum-error Neural Network.

The architecture of the developed Neural Network as follows:

- 5 Input Nodes.
- 12 Hidden Nodes.
- 2 Output Nodes.
- With Back-Propagation as learning algorithm with Sigmoid function
- 243 Patterns

The main purpose is to make this Neural Network fits the proposed system and gives the ability to expand Neural Network's patterns as we will see below.

5. COMPARISON BETWEEN LUP AND LUP-AS

The aim of this section is to compare the proposed algorithm with the classical LUP and to show the main features of the proposed algorithm over the classical one. In order to achieve this goal, two examples will be considered.

Table 2 is an example of how the sequences of bidding process in an auction using LUP auction. The table is consists of six columns respectively as follow: The name of bidder, the submitted bid by the bidder, the amount of bids number, the name of current winner, the current winner price, and the cause why the bid price is accepted or not. In this table, Least means that the submitted price is less than or equal to the current winner price.

Table 2. An Example Of Events During LUP Auction
(IN APPENDIX A-2)

As seen in the above auction: the market price of the product is 10\$, there are 4 bidders and they made 9 bids. The most important behavior in this auction is that all the submitted prices are ONE dollar. Moreover, the final winner was Mohammed because he submitted his bid 1\$ when the amount was 9\$; so, the auction will closed automatically because his bid and the mount is equal to the market price of the product. The winner (Mohammed) will pay 5\$: four participants plus his final winner price. However, the winner this auction has to have luck to win without follow any bidding strategy. In other words, if there was new

bidder called Rami and he submitted 1\$ before last bid by Mohammed, then the winner will be Rami and he will take the product with 2\$ (1\$ for the participation, 1\$ for his winner price).

In the other side, Least in LUP-AS means that the submitted price is less than or equal to the current winner price and is greater than the number of cancelled bids. Table 3 is an example of how the sequences of bidding process in an auction using LUP-AS auction. There is an additional column in compare with table 2. The additional column is the fifth one which represents the Number of Cancelled Bids which makes the differences between the two intended algorithms.

Table 3. An Example Of Events During LUP-AS Auction
(IN APPENDIX A-3)

As seen in the above auction: the market price of the product also is 10\$, there are 4 bidders and they made 7 bids (The duration of LUP-AS is shorter than the traditional LUP). Unlike LUP, the most important behavior in this auction is that the bidders cannot submit ONE dollar every time. Moreover, the final winner was Mohammed because he submitted his bid 3\$ when the amount was 7\$; so, the auction will closed automatically because his bid and the mount is equal to the market price of the product. The winner (Mohammed) will pay 6\$: three participants plus his final winner price.

Unlike the proposed auction mitigates a luck as much as possible and the winner must follow certain bidding strategy. In other words, if there was new bidder called Rami and he submitted 1\$ before last bid by Mohammed, then Rami will be lost because the amount 7\$ and the auction will not be closed ($1\$ + 8\$ < 10\$$). As well, the bid price of Ali 1\$ is less than the Number of Cancelled Bids which is 3\$ at that point.

The last and the main feature of LUP-AS over the traditional LUP is how to attract the bidders to submit the first bid, because this will be useless for the bidder (i.e. it will be cancelled by any other submitted bid). In LUP-AS, if the auction is closed without winner (two bidders are least, unique, and their bids are greater than TheNumberOfCancelledBids and the price of the item is calculated by the submitted bids by all bidders), then the first submitted bid later will win. However, it must match the winning scenario.



6. CONCLUSIONS

This paper presents and implements a new type of online auction called LUP-AS which adopts playing game style. The LUP-AS can be classified as a semi-sealed auction (only the current/intermediary winner name is displayed, while his bid price is hidden). The proposed auction is generally suitable and its duration is too short when the number of bidders is huge and item price is very cheap like mobiles. Moreover, the winner pays a very low price and always is less than the market price. At the other side, the seller will gain the revenue equals to the acceptable or market price (the fear price). LUP-AS resolved the sniping problem that found in most auction types, because it is a dynamic auction and its closing time is not known for the bidders. Generally, LUP-AS decreases the auction duration in comparison with the classical LUP.

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APPENDIX A-1

Table 1. Decision Table Of The LUP-AS Scenarios

The Submitted Price	Unique	Not Unique
Least and >NumberOfCancelledBids	(1) Win	(2) Lose
Least and <=NumberOfCancelledBids	(3) Lose	(4) Lose
Not Least and >NumberOfCancelledBids	(5) Lose	(6) Lose
Not Least and <=NumberOfCancelledBids	(7) Lose	(8) Lose

APPENDIX A-2

Table 2. An Example Of Events During LUP Auction

Bidder's Name	Submitted Bid	Amount	Name of the Current Winner	Current Winner Price (it is hidden)	Cause
Mohammed	1	1	Mohammed	1	Least & Unique
Ahmad	1	2	Null	Null	Duplicate Least Price
*Mohammed	1	3	Mohammed	1	Least & Unique
Omar	1	4	Null	Null	Duplicate Least Price
Walid	1	5	Walid	1	Least & Unique
Ahmad	1	6	Null	Null	Duplicate Least Price
Mohammed	1	7	Mohammed	1	Least & Unique
Ahmad	1	8	Null	Null	Duplicate Least Price
Mohammed	1	9	Mohammed	1	Least & Unique



APPENDIX A-3

Table 3. An Example Of Events During LUP-AS Auction

Bidder's Name	Submitted Bid	Amount	Name of the Current Winner	Current Winner Price (it is hidden)	Number of Cancelled Bids	Cause
Mohammed	4	1	Mohammed	4	0	Least & Unique & > Number of Cancelled Bids
Omar	2	2	Omar	2	0	Least & Unique & > Number of Cancelled Bids
Walid	2	3	Null	Null	1	Duplicate Least Price
Mohammed	2	4	Mohammed	2	1	Least & Unique & > Number of Cancelled Bids
Walid	1	5	Mohammed	2	1	Least & Unique <i>but</i> ≤ Number of Cancelled Bids
Walid	2	6	Null	Null	2	Duplicate Least Price
Mohammed	3	7	Mohammed	3	2	Least & Unique & > Number of Cancelled Bids

APPENDIX B-1

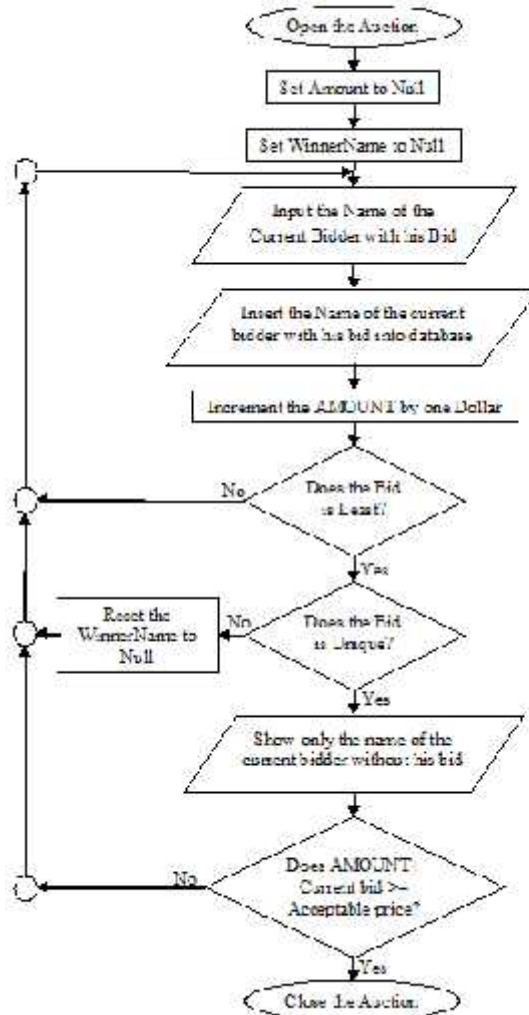


Figure 1. Flow Chart Of LUP Algorithm

APPENDIX B-2

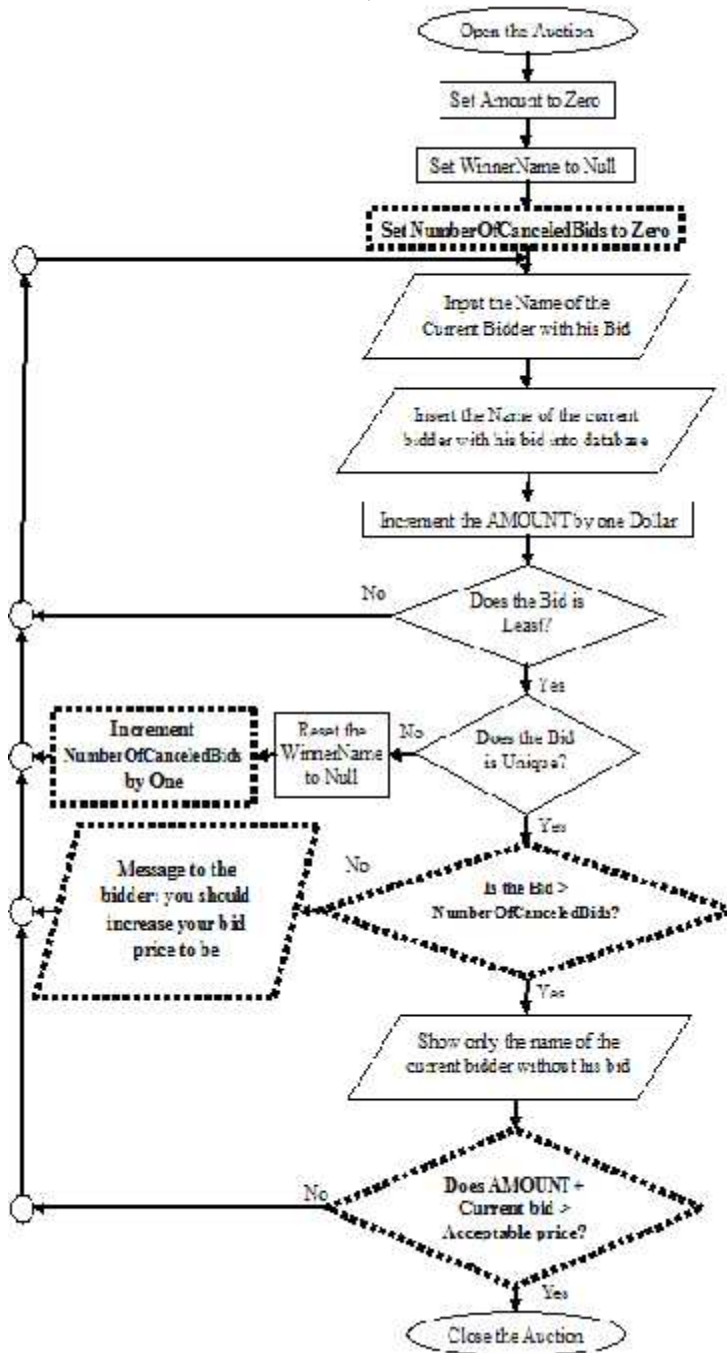


FIGURE 2. FLOW CHART OF LUP-AS ALGORITHM

APPENDIX B-3

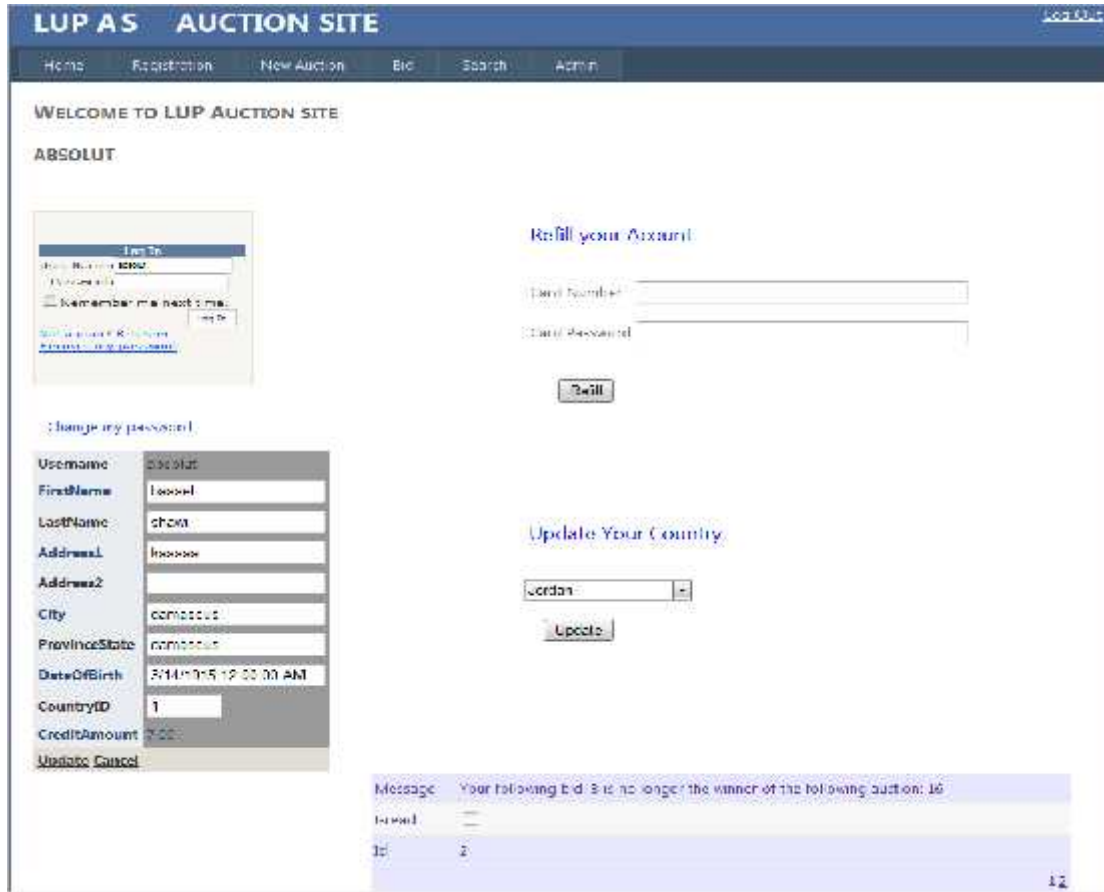


Figure 3. User Profile Interface

APPENDIX B-4

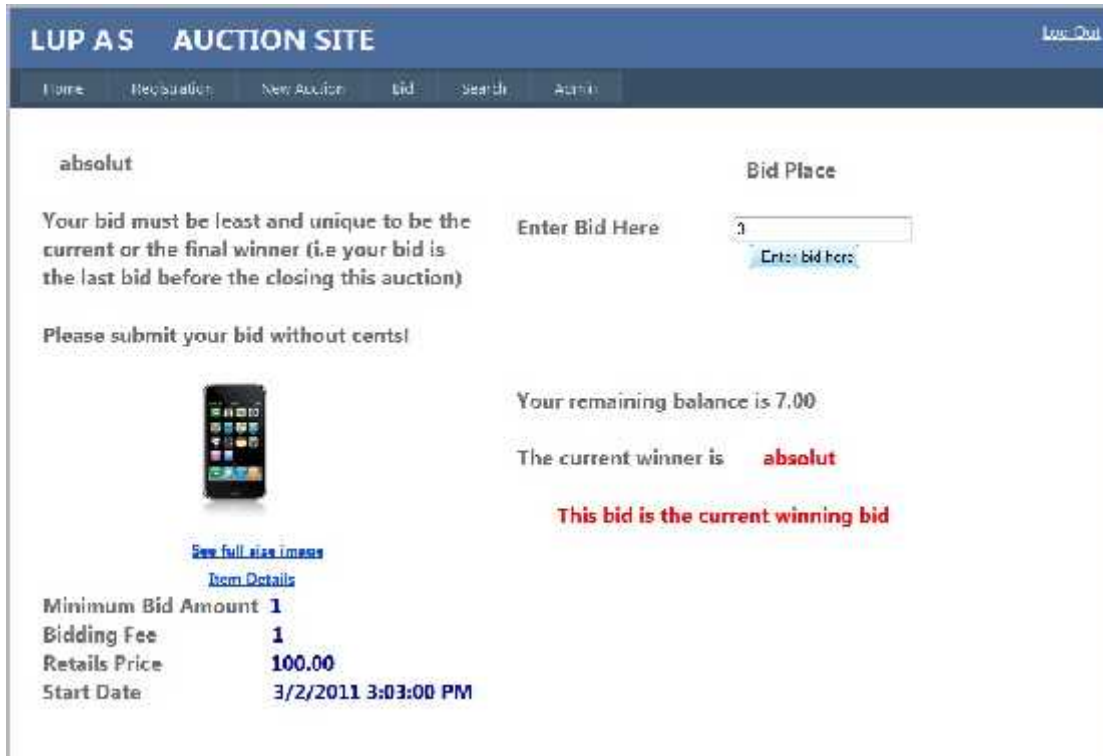


Figure 4. Bidding Interface

APPENDIX B-5

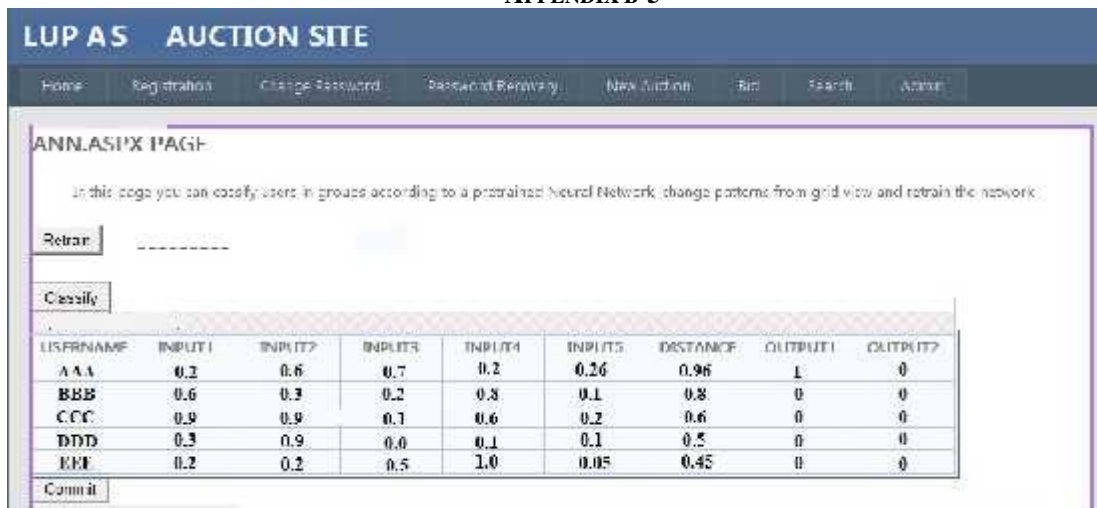


Figure 5. ANN Page