~~To obtain the~~One solution for obtaining an equilibrium outcome in ~~the~~an incomplete information SSA~~, building the~~ is to build an incentive~~ -~~compatible mechanism~~ is a solution~~, such as the VCG auction. However, Rothkopf ~~conclude~~has provided thirteen reasons ~~of the hardness~~ for ~~the~~why achieving a VCG implementation is hard.

Edelman et al. ~~focus~~focused on the SSA with simultaneous-move, one-shot, and complete information assumptions to derive the locally envy-free equilibrium. ~~At~~Varian independently derived the same ~~time, Varian concludes the same results termed~~ result and called it the symmetric Nash equilibrium. Edelman et al. ~~design the~~designed a generalized English auction with a central clock ~~in~~for the incomplete ~~SSA to obtain the~~information SSA case and obtained an equivalent result ~~of~~for the equilibrium outcome.

Babaioff and Roughgarden extended the English auction (the central clock version) from the complete information SSA to the incomplete ~~one.~~information SSA. Their auction mechanism, known as the ascending implementation, is similar to that proposed by Edelman et al. ~~The mechanism is named as the "ascending implementation." The authors show~~They showed that the equilibrium exists in the anonymous, upper-triangular, and strictly locally monotone payment function ~~with~~having the "onto" property~~."~~.

If the auctioneer ~~would like to obtain~~desires an equilibrium outcome, the existence of the equilibrium ~~existence~~ must first be confirmed ~~firstly~~. Gottlob et al. ~~introduce~~showed that determining whether a game has a pure Nash or Pareto equilibrium is an NP-complete~~. Even~~ problem. Obtaining the equilibrium outcome is hard even if there are ~~limitative~~limiting constraints on the players' strategies~~, obtaining the equilibrium outcome is hard.~~. More precisely, computing the equilibrium is PPAD-hard. Therefore, ~~reaching~~it is hard to determine the equilibrium efficiently in ~~the on-line~~an internet-based application ~~is hard, and~~. Thus, we focus on deriving ~~the~~a result that is equivalent to the equilibrium outcomes. In other words, the ranking result and ~~SEP's~~SEP revenue derived in this paper are identical to ~~that~~those in the equilibrium outcome.

2 Auction Model

We ~~follow~~utilize the repeated SSA model proposed by Cary et al. ~~in~~ [1]. An SSA instance $\Gamma = \{AD, SL, B\}$ includes the following elements.

- A set of advertisers $AD = \{ad_1, ad_2, \ldots, ad_n\}$. ~~As~~Upon receiving a click, the advertiser ad_i will ~~obtain the income~~earn an amount v_i. Only rational advertisers are

註解 **[Editor1]:**
Golden English Editing
Humanities & Social Sciences
Economics
Sample of work

註解 **[Editor2]:**

CHECK: Please check that the changes convey your intended meaning.

註解 **[Editor3]:**

CHECK: Please check that the changes convey your intended meaning.

considered in this paper~~. This means that~~: each advertiser will update his/her bid only if winning ~~the other~~another slot is more beneficial.

◦ A set of slots $SL = \{sl_1, sl_2, \ldots, sl_k\}$. Each slot sl_j has a click-through--rate (CTR) θ_j, which ~~is~~represents the probability that ~~the Internet~~a user will click the advertisement ~~on~~in sl_j. Each sl_j is quantified by θ_j, i.e.~~.~~, $\theta_1 > \theta_2 > \ldots > \theta_k$.

◦ A bid profile $B = \{b_1, b_2, \ldots, b_n\}$. ~~As~~On receiving a keyword query, each ad_i submits a bid ~~price~~ b_i ~~to declare~~representing the maximum payment~~.~~ they are willing to offer. Since advertisers are rational, no overbidding~~,~~ (i.e., $v_i < b_i$, will ~~take place~~occur. In the repeated model, one keyword phrase is considered~~, and all~~. All settings are consistent in each round, including the number of the advertisers and the valuations.

When the SEP receives ~~any~~a keyword query, the following procedures are invoked~~.~~:

- Ranking function. ~~Determine a rank~~Determines the ranking result $\pi : SL \to AD$, ~~e.g.~~ ad_{π_j} is the winner of sl_j.
- Charging function. ~~Charge~~Charges p_{π_j} to ad_{π_j} by a considered pricing mechanism.

~~In~~At the end of each round, the SSA mechanism outputs a ~~rank~~ranking result and ~~the~~ payment profile.

~~We consider~~Under the pay-per-click~~, so~~ mechanism, each participant takes into account the expected worth. Given the bid profile B, ~~each~~ ad_{π_j}'s the expected utility of each ad_{π_j}'s is denoted by $u_{\pi_j}(B) = \theta_j(v_{\pi_j} - p_{\pi_j})$~~, and~~. The revenue received by the SEP will be~~receive the revenue~~ $TR = \sum_{\forall s \le k} p_{\pi_s}\theta_{\pi_s}$. Therefore, the social welfare of the SSA is calculated by $W = TR + \sum_{\forall s \le k} u_{\pi_s}(B) = \sum_{\forall s \le k} v_{\pi_s}\theta_{\pi_s}$.

The auction efficiency, which is ~~shown~~outlined in ~~definition~~Definition 1, ~~and that~~ can be used to ~~measure~~calculate the outcome quality. The social welfare represents the ~~whole~~total worth in the auction. As the social welfare is maximized, the outcome ~~does not bias~~becomes unbiased towards either the advertisers or the SEP.

註解 [Editor4]:

CHECK: The intention of the word “considered” here is not clear. Who is considering the pricing mechanism? When is it considered? Perhaps the following choices would reflect your intended meaning more clearly:
…by a predetermined pricing mechanism.
…by a given pricing mechanism.
…by a dynamic pricing mechanism.