Summary: A Nash equilibrium is a significant notion in population games, that is, when a strategy is chosen by a game player, the player cannot unilaterally change the strategy to obtain higher profits than the incumbent one. However, the switches for strategies in real decision-problems also cause the resulting costs. And an example is given to illustrate the effects of costs on Nash equilibria of classical population games. This paper introduces the cost function of game agents to classical population games and establishes a new model for population games. Then, a new concept, a weak Nash equilibrium, is proposed. The underlying idea is that when the resulting cost of changing strategies is greater than or equal to the increase in profits, the game agent has no incentive to switch the current strategy and thus the undergoing population games reach a weak Nash equilibrium. Furthermore, the existence of weak Nash equilibria is proved by Brouwer’s fixed point theorem. Finally, the generic stability of weak Nash equilibria for population games is proved by Fort theorem when the net profit function is perturbed.

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