Guideline: These are short-answer questions that must be done individually. Write your answer in the space provided. No justification is required. The completed HW must be handed back in class on the due date.

Problem 1. For each of these statements, circle whether they are **T** (True) or **F** (False). You do not need to provide a justification.

T   **F**   A dominant strategy equilibrium of a game is also a pure Nash equilibrium.

T   **F**   There can be more than one pure Nash equilibrium in a game.

T   **F**   A pure Nash equilibrium must always exist in every game.

T   **F**   Truthful bidding is a dominant strategy in a single-item sealed-bid auction where the item is awarded to the second-highest bidder at a price equal to the third highest bid.

Problem 2. Consider a single item auction with four bidders $N = \{1, 2, 3, 4\}$ with private values $v_1 = 2$, $v_2 = 10$, $v_3 = 5$ and $v_4 = 12$ for the item. Fill in the blanks below.

(a) The expected social welfare generated by the lottery auction on this input is [   ].

(b) The bid profile at the dominant-strategy equilibrium of the second-price auction is $(b_1, b_2, b_3, b_4) =$ [   ].

(c) The winner of the second-price auction is [   ] and their payment is equal to [   ].

(d) Suppose bidders $1, 2$ and 3 bid truthfully. Then, the bid that maximizes the utility of the bidder 4 in a first-price auction is $b_4 =$ [   ].[1]

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[1] Assume that bids must be in the form of dollars and cents, and not an arbitrary precision real number.