Revisit the activity selection problem. Given a set of activities $S = \{a_1, a_2, \cdots, a_n\}$ that wish to use a resource, each a_i takes place during a time interval. The goal is to arrange as many compatible activities as possible. Recall that several greedy approaches are introduced in the class, among which the one selecting an activity with the shortest length, denoted by SF, is not always optimal. However, we claim that SF accepts at least $|OPT|/2$ activities, given that the optimal value is $|OPT|$, where OPT is an optimal solution. Check if the following is a correct proof.

We use a technique, called the charging scheme, similarly as the amortized analysis. Suppose each accepted activity of OPT holds one dollar, which will be given to the activities accepted by SF in the following way. For any activity a_i of OPT, if a_i is also accepted by SF, give the dolloar to itself. Otherwise, there must be some activity a_j, accepted by SF, is not compatible with a_i. Then a_j receives one dollar from a_i. Along this line, each activity of OPT sends out one dollar to an activity in SF, while each activity of SF receives at most two dollars. It implies that SF accepts as least $|OPT|/2$ activities.

○ T ○ F

答案正确：3 分 创建提问

An $(1+\epsilon)$-approximation scheme of time complexity $(n+1/\epsilon)^3$ is a PTAS but not an FPTAS.

F

In the bin packing problem, we are asked to pack a list of items L to the minimum number of bins of capacity 1. For the instance L, let $FF(L)$ denote the number of bins used by the algorithm **First Fit**. The instance L' is derived from L by deleting one item from L. Then $FF(L')$ is at most of $FF(L)$.

○ T ○ F

答案正确：2 分 创建提问

In the bin packing problem, suppose that the maximum size of the items is bounded from above by $\alpha < 1$. Now let's apply the Next Fit algorithm to pack a set of items L into bins with capacity 1. Let $NF(L)$ and $OPT(L)$ denote the numbers of bins used by algorithms Next Fit and the optimal solution. Then for all L, we have $NF(L) < \rho \cdot OPT(L) + 1$ for some ρ Which one of the following statements is FALSE?

○ A. $\rho = \frac{1}{1-\alpha}$, if $0 \leq \alpha \leq 1/2$.

○ B. $\rho = 2$, if $\alpha > 1/2$.

○ C. If L = (0.5, 0.3, 0.4, 0.8, 0.2, 0.3), then $NF(L) = 4$.

○ D. $\rho = 2\alpha$ if $0 \leq \alpha \leq 1$

答案正确：3 分 创建提问

Assume P≠NP, please identify the false statement.

○ A. There cannot exist a ρ-approximation algorithm for bin packing problem for any $\rho < 3/2$.

○ B. In the minimum-degree spanning problem, we are given a graph G=(V, E) and wish to find a spanning tree T of G so as to minimize the maximum degree of nodes in T. Then it is NP-complete to decide whether or not a given graph has minimum-degree spanning tree of maximum degree two.

○ C. In the minimum-degree spanning problem, we are given a graph G=(V, E) and wish to find a spanning tree T of G so as to minimize the maximum degree of nodes in T. Then there exists an algorithm with approximation ratio less than 3/2.

○ D. In the knapsack problem, for any given real number $\epsilon > 0$, there exists an algorithm with approximation ratio less than $1+\epsilon$.

C