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**1. Graded Problems**

* **[Question 1]**

True.

* **[Question 2]**

False.

* **[Question 3]**

This problem can be validated in polynomial time checking does the union of all sets have size *k* or less, thus it is NP. We will now show the Vertex Cover is reducible to Hitting Set. Given an instance of Vertex Cover (i.e: *G =* (*V, E*) and an integer *k’*), we will construct an instance of Hitting Set. The plan is, we put each node *i* of *G* and all its adjacent nodes into a set , and finally let *k = k’*. This construction can be done in polynomial time in size of the Vertex Cover instance. We now run our black box for the Hitting Set problem and return the same result it gives. To prove that this answer is correct, we simply need to show that *G* has a vertex set of size *k’* if and only if the hitting set instance has a hitting set of size *k*. (Note *k=k’*)

* **[Question 4]**

Let *A* denote the 3-SAT and let variables *e*, *f* and *s* denote number of desks plan to build in cabinet shop, the finishing shop, and the crating shop, respectively. Then we have the following constraints:

*0 ≤ e, 0 ≤ f*, *0 ≤ s*

*2 \* e + f + s ≤ 16*

*e + 2 \* f + s ≤ 16*

*e + f + 0.5 \* s ≤ 10*

And the objective function is: Maximize *150 \* e + 125 \* f + 50 \* s*