Question 2.20 in DPV Write succinct pseudocode for your method.

Answer: The following pseudocode counts the number of entries in x with a given value. We input $M_{min} = \min_i x_i$ and $M_{max} = \max_i x_i$. Indices start at 0.

```
SORT(Mmin,Mmax,x)
    initialize an all-zero array S with Mmax − Mmin +1 entries
    initialize an array y the same size as x
    for i=0 ...n− 1
        increase S[x(i) − Mmin] by one
    for j =0 ...M − 1
        if S[j] >0
            for k =1 ...S[j]
                y[j+ k− 1] = j+ Mmin
    return y
```

Since the algorithm has one loop with n iterations and one loop with M iterations (writing to an array of length n), the running time is O(n+ M).
The sorting lower bound does not hold because comparisons are not used in this sorting algorithm. Only simple array accesses are used.

discussion forum questions Show that the following problems are in NP (and give the poly-time verifiers):

COMPOSITE Is the integer x the product of two other integers?
SET COVER Given a collection of sets $S_1,\ldots,S_m$ of a ground set and an integet k, determine if there exists a subcollection of size k such that the union of the sets in the subcollection is the same as the union of the sets in the collection.
SAT (See DPV for a definition)
ROOT Given a polynomial P(x) (e.g. $P(x)= x^3 - 3x+ 1$) and an interval [a,b], does P have a root in [a,b], i.e. does there exist an integer x s.t. $a \le x \le b$ s.t. P(x) = 0 (What if x is not required to be an integer?)

answer should be easy