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Homework #8

1.a. FLOYD_WARSHALL(W)

```
n = W.rows
D = W
for k=1 to n do
    for i=1 to n do
        for j=1 to n do
            dij = min(dij, dik+dkj)
return D
```

Since d_{ik} and d_{kj} are never overwriten in each iteration, you can get away with using the same matrix for the whole algorithm. After the outer loop terminates $k=n$ and D will be computed the same way to make $D^{(n)}$

b. FLOYD_WARSHALL (W)

```
n= W.rows
D=W
P= new nxn matrix
for i=1 to n do
  for j=1 to n do
    if(i=j)or(dij=∞) then
        pij = NIL
    else
        pij = i
for k=1 to n do
    for i=1 to n do
        for j=1 to n do
            if dij > dik+dkj then
                dij = dik+dkj
                pij = pkj
return P
```

2. No, it would only imply that any NP problem can be solved in polynomial time, not necissarily $O(n^5)$. By definition any NP problem can reduce to NP-complete in polynomial time but that transformation could be $> O(n^5)$.

3. a. SORT = { A | A is an array and it is in sorted order }

b. MIN = { A, x | A is an array of numbers with a minimum of x }

c. LONGEST_PATH = { G, B | G is some graph with no path > B }

4.
```
if |S'| ≤ k then
    found = false
    for c in C do
        for x in c do
            for s in S' do
                if s = x then
                    found = true
        if found = true then
            found = false
        else
            return false
    return true
return false
```

Since a solution to the decision problem can be found in polynomial time, the hitting set problem is in NP

5. if π traverses each vertex only once
    if π contains real edges
        if $K = \pi.length$
            return true
return false

6. HAM-PATH = { G | G is a graph and there is a simple path that contains every vertex in G }

7. $A(G, \pi)$
  if $\pi.length = G.V - 1$
    if π contains no repeat vertities
      return true
  return false

8. HAM-CYCLE (G, π)
    if $\pi[1] = \pi[\pi.length]$
        return HAM-PATH$(G, \pi[1, \dots \pi.length - 1])$
    return false

- Hamilton cycle is a path with one extra condition

9. HAM-PATH (G, π)
    if $\pi.length = G.V - 1$
        return longest-path$(G, \pi, \pi.length)$
    return false