Homework 4

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Problem: 1

1. **Source-removal algorithm:**
   (a) Find nodes with no incoming edges.
   (b) Remove these source nodes and their outgoing edges.
   (c) Repeat the process until all nodes are removed.

   For graph (a):

   - Remove node c.
   - Remove node a.
   - Remove node b.
   - Remove node d.
   - Remove node f.
   - Remove node g.

   For graph (a):

   $$c, a, b, d, f, g$$

   For graph (b):

   $$a, b, c, d, e, f, g$$

Problem: 2

2. **Cutting a stick into n pieces with the min number of cuts:**
   (a) Cut the stick in half .
   (b) Put all the pieces together and cut in half again.
   (c) Repeat the process.
   (d) The number of pieces doubles after each cut.

   The formula for the minimum number of cuts is:

   $$\lceil \log_2 n \rceil$$

Problem: 3

To use quicksort to sort the list: `E, X, A, M, P, L, E`.

1. Start with the original list: `E, X, A, M, P, L, E`.
2. Choose the first element as the pivot: `E`.
3. Divide the list:
   - Left: `A, E`
   - Pivot: `E`
   - Right: `X, M, P, L`
4. Sort the left part `A, E`:
   - Choose `A` as the pivot.
   - Sorted result: `A, E`.
5. Sort the right part `X, M, P, L`:
   - Choose `X` as the pivot.
   - Sort: `M, P, L`
6. Sort `M, P, L`:
   - Choose `M` as the pivot.
   - Sorted result: `L, M, P`.
7. Combine everything:
   - Left part: `A, E`.
   - Pivot: `E`.
   - Right part: `L, M, P, X`.

Final sorted list: `A, E, E, L, M, P, X`.