1) a) $^7C_5 = 21$ unique sets

    b) $^7P_5 = 2,520$ unique strings /arrangements

2) $^{13}C_2 \times {}^4C_2 \times {}^9C_2 \times {}^{11}C_1 \times {}^4C_1$
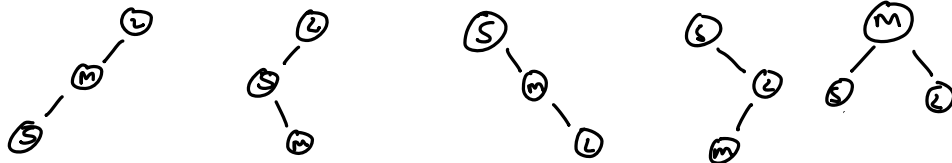
    $= 123552$ ways

3) $^{16}C_6 + {}^{15}C_6 = 13,013$ ways

4) Ways to form BST with 2 nodes: 2 ways

    Ways to form BST with 3 nodes:

    [5 ways]

    Ways to form BST with 4 nodes:
    Let 4 nodes be 1,2,3,4:   With 4 as root, 5 cases
                                     With 3 as root, 2 cases
    [14 ways]   With 2 as root, 2 cases
                                     With 1 as root, 5 cases

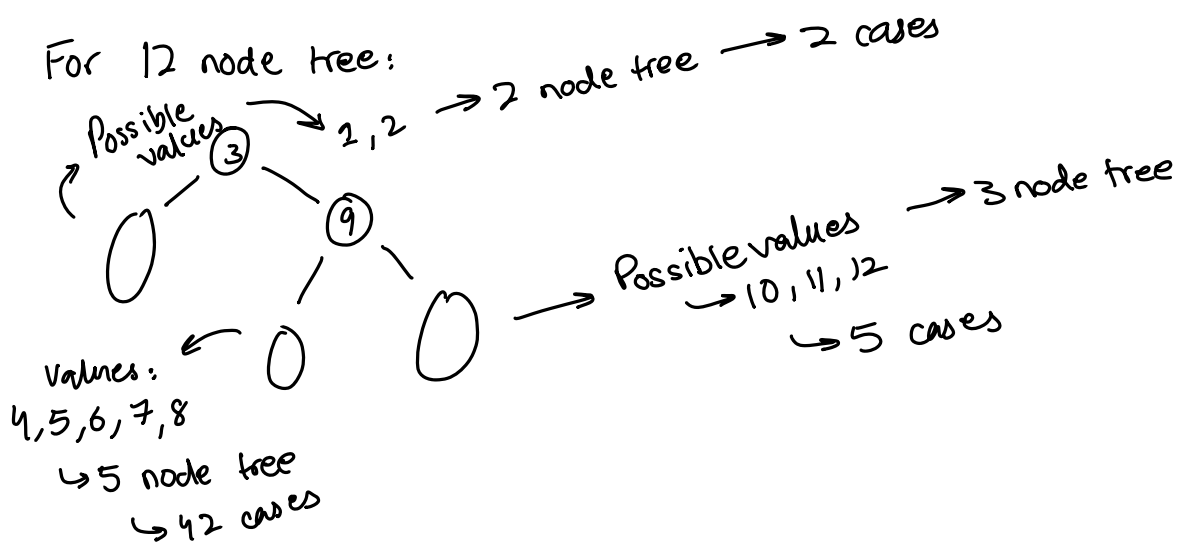   Ways to form BST with 5 nodes:

        With 5 as root, 14 cases
        With 4 as root, 5 cases   [42 ways]
        With 3 as root, 2×2 = 4 cases
        With 2 as root 5 cases
            With 1 as root 14 cases

For 12 node tree:

Possible values → 2,2 → 2 node tree → 2 cases

③ → 2 node tree → 2 cases

⑨

Possible values → 3 node tree
→ 10, 11, 12
→ 5 cases

values:
4,5,6,7,8
→ 5 node tree
→ 42 cases

AMS : 2×5 × 42 = 420 ways

5) With repetition b/c nurses can be selected for more than one student.

All cases with no restriction:

$$\binom{n-1+r}{r} = \binom{10-1+4}{4} = {}^{13}C_4 = 715$$

If → ${}^{12}C_3 = 220$
2 nurse is
off duty

Total : 935

Cases where all nurses don't serve atleast 2:

guarantees atleast one nurse serves 0 ppl
$$\binom{10-1+2}{2} = \binom{11}{2} \rightarrow \text{offduty nurse} = 55$$

$$\binom{10-1+3}{3} = \binom{12}{3} \rightarrow \text{On duty nurse} = 220$$

Total : 275

935 − 275 = 660 ways total