Katie Prescott

I pledge my honor that I have abided by the Stevens Honor System.

Homework 4

1. Copy L1 in regular order instead of reverse order to L2.

2. 72×93

n	m
72	93
36	186
18	372
9	744
4	1488
2	2976
1	5952

744

5952

$\boxed{6696}$

3. a. an already sorted list
   b. $\theta(n^2)$

4. $2205 \times 1132 = 2,496,060$

$a_1 | a_0 \quad b_1 | b_0$
$22 | 05 \times 11 | 32$

$C_2 = a_1 \times b_1 = 22 \times 11 = 242$

$C_0 = a_0 \times b_0 = 05 \times 32 = 160$

$C_1 = (a_1 + a_0) \times (b_1 + b_0) - (c_2 + c_0)$

$27 * 43 - 402 = 759$

$C_2 10^n + C_1 10^{n/2} + C_0$

$2420000 + 75900 + 160$

$= \boxed{2496060}$

$a_1 | a_0 \quad b_1 | b_0$
$2 | 2 \times 1 | 1$

$C_2 = 2 \times 1 = 2$

$C_0 = 2 \times 1 = 2$

$C_1 = 4 \times 2 - 4 = 4$

$C_2 10^n + C_1 10^{n/2} + C_0$

$200 + 40 + 2$

$= \boxed{242}$

$a_1 | a_0 \quad b_1 | b_0$
$0 | 5 \times 3 | 2$

$C_2 = 0 \times 3 = 0$

$C_0 = 5 \times 2 = 10$

$C_1 = 5 \times 5 - 10 = 15$

$C_2 10^n + C_1 10^{n/2} + C_0$

$0 + 150 + 10$

$= \boxed{160}$

$a_1 | a_0 \quad b_1 | b_0$
$2 | 7 \times 4 | 3$

$C_2 = 2 \times 4 = 8$

$C_0 = 7 \times 3 = 21$

$C_1 = 9 \times 7 - 29 = 34$

$C_2 10^n + C_1 10^{n/2} + C_0$

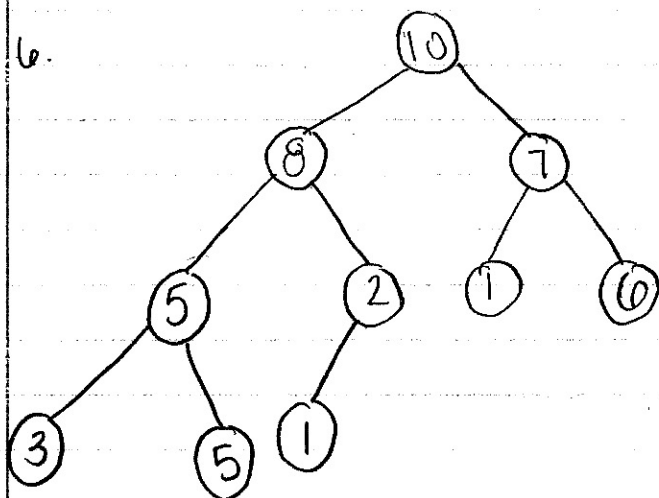$800 + 340 + 21$

$= \boxed{1161}$

5.

```
                    (24)
                   /    \
               (18)      (67)
              /    \    /    \
          (11)   (19)(25)   (68)
                    \          \
                   (20)       (69)
                                 \
                                (93)
```

6.

```
                (10)
               /    \
            (8)      (7)
           /  \     /  \
        (5)   (2) (1)  (6)
       /     /  \
    (3)   (5)  (1)
```
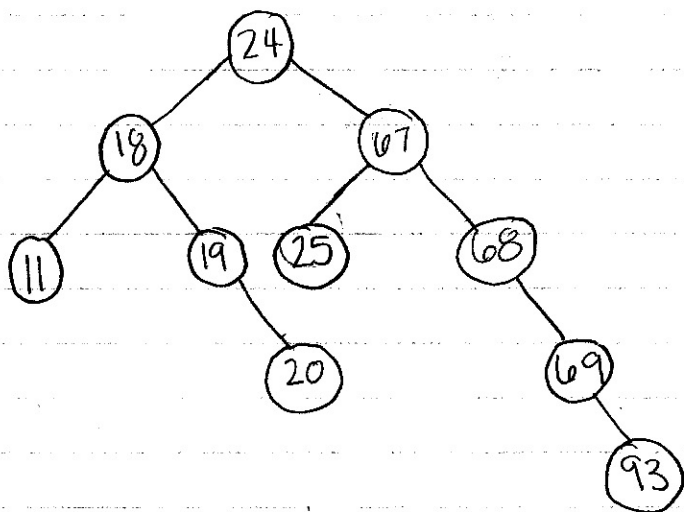
a) pre-order: 10 8 5 3 5 2 1 7 1 6
b) in-order: 3 5 5 8 1 2 10 1 7 6
c) post-order: 3 5 5 1 2 8 1 6 7 10
d) How many internal nodes? 4
e) How many leaves? 5
f) Maximum width? 4
g) Height: 3

7. a) $T(n) = 2T(n/4) + 1$

   $a = 2$
   $b = 4$
   $f(n) = 1 \to d = 0$

   $2 > 4^0 \to T(n) = \theta(n^{\log_4 2}) \to \boxed{T(n) = \theta(\sqrt{n})}$

b) $T(n) = 2T(n/4) + \sqrt{n}$

   $a = 2$
   $b = 4$
   $f(n) = \sqrt{n} \to d = \frac{1}{2}$

   $2 = 4^{\frac{1}{2}} \to \boxed{T(n) = \theta(\sqrt{n} \, \log_4 n)}$

c) $T(n) = 2T(n/4) + n$

   $a = 2$
   $b = 4$
   $f(n) = n \to d = 1$

   $2 < 4^1 \to \boxed{T(n) = \theta(n)}$

d) $T(n) = 2T(n/4) + n^2$

   $a = 2$
   $b = 4$
   $f(n) = n^2 \to d = 2$

   $2 < 4^2 \to \boxed{T(n) = \theta(n^2)}$

e) $T(n) = 2T(n/4) + n^3$

   $a = 2$
   $b = 4$
   $f(n) = n^3 \to d = 3$

   $2 < 4^3 \to \boxed{T(n) = \theta(n^3)}$

8. a) $T(n) = 5T(n/3) + n^{3/2}$
   b) $a = 5, b = 3, d = 3/2$

   $5 < 3^{3/2} \longrightarrow \boxed{T(n) = \theta(n^{3/2})}$