CSI 33 **Solutions to Chapter 1 exercises**

Short Answer

8. a)

```
n = input('enter n: ')   1 operation
for i in range(n):        n iterations
     x = 2 * n            2 operations (math *, assignment)
     while x > 1:         log_2 x + 1 iterations (because x is reduced
          x = x/2            at each iteration - it becomes half of the
                           previous x's value - like in binary search)
```

T(n) = 1 + n(2+logn + 1) = nlogn + 3n + 1

T(n) = Θ(n logn) - asymptotic running time

b) T(n) = Θ(n)

```
n = input('enter n: ')   1 operation
total = 0               1 operation
for i in range(n):             n iterations
     for j in range(10000):         10 000 iterations
          total += j           1 operation
print total               1 operation
```

T(n) = 3 + 10000n

Since the asymptotic running time is discussed when n → ∞, 10000 becomes insignificantly small there, hence **T(n) = Θ(n)**

c) $T(n) = \Theta(n^2)$

```
total = 0                 1 operation
n = input('enter n: ')    1 operation
for i in range(2*n):
     for j in range(i,n):  2n + (2n-1) + (2n-2) + (2n-3) + … + 2 + 1
                                                             iterations
          total += j                    1 operation
for j in range(n):        n iterations
     total += j                1 operation
```

$T(n) = 2 + 2n^2 + n + n = 2n^2 + 2n+1$, hence **$T(n) = \Theta(n^2)$**

$$1+2+3+\ldots 2n = \frac{2n(1+2n)}{2} = 2n^2 + n$$