Q3.

a) $i=2$ $\quad 2^{2^k}$

```
while (i<n)
{
    i = i * i      2, 4, 16
}
```

$2^k \cdot \log 2 = \log n$

$\log(2^k \cdot \log 2) = \log(\log n)$

$k \cdot \log(2 \log 2) = \log(\log n)$

$\Theta k < \log(\log n)$

b) $n=9$ the "if" triggers for $i = 3, 6, 9$ $\quad i = k\sqrt{N}$

$n=16$ " " $i = 4, 8, 12, 16$

$$T(n) = \sum_{i=1}^{n} \Theta(1) + \sum_{k=1}^{\sqrt{n}} \sum_{j=0}^{i^3-1} \Theta(1)$$

geometric?

$$= \Theta(n) + \sum_{k=1}^{\sqrt{n}} \Theta(i^3)$$

$$= \Theta(n) + \sum_{k=1}^{\sqrt{n}} \Theta((k\sqrt{n})^3)$$

$\sum_{x=1}^{y} x^3 = \frac{1}{4} y^2 (y+1)^2$

$\Theta(n^{7/2}) = \frac{1}{4} y^4 + \Theta(y^3)$

$= \frac{1}{4} n^{4/2} \cdot n^{3/2} = n^{7/2}$

$\Theta(n^2)$

c) $$\sum_{i=1}^{n} (\Theta(n) + \sum(\Theta(\log(n))$$

$$\sum_{i=1}^{n} (\Theta(n) + \sum_{j=1}^{n} (\Theta(\log(n))$$

$$\sum_{i=1}^{n} (\Theta(n) + \Theta(n \log(n))$$

$$2 \cdot \Theta(n^2) + \Theta(n^2 \log(n))$$

$$\Theta(n^2 \log(n)) > \Theta(n^2)$$

$$= \Theta(n^2 \log(n))$$

d. $\sum_{i=0}^{n-1} \left(\Theta(1) + \sum_{j=1}^{2size} \Theta(1) \right)$ if statement best worst case runs twice

$= \Theta(n) + \Theta(2n \cdot size)$

$= \Theta(n + size)$