Big-O-Notation (unfolding the definition).

If $g(n) = O(f(n))$ then there exist $c > 0$ and $n_0 \geq 1$ such that $\forall n \geq n_0$ we have $g(n) \leq c \cdot f(n)$.

1. $\frac{n^2}{3} - 3 \cdot n = O(n^2)$ {let $n = 2$}.

$\frac{n^2}{3} - 3 \cdot n \leq 2 \cdot n^2$; $-3 \cdot n \leq \frac{5n^2}{3}$; $-3 \leq \frac{5 \cdot n}{3}$

We choose $n_0 = 1$. Therefore $\frac{5n}{3}$ is always positive and greater than -3. So, $\frac{n^2}{3} - 3 \cdot n = [O(n^2)] \Rightarrow$ true.

2. $k_1 n^2 + k_2 n + k_3 = O(n^2)$ {let $c = k_1 + 1$}

$k_1 n^2 + k_2 n + k_3 \leq (k_1 + 1) \cdot n^2$; $k_2 \cdot n + k_3 \leq n^2$

$\frac{k_2}{n} + \frac{k_3}{n^2} \leq 1$. We choose $n_0 = 4 \cdot \max^{n}(|k_2|, \sqrt{|k_3|}, 1)$

Therefore, $\frac{k_2}{n} \leq 0.25$; $\frac{k_3}{n^2} \leq 0.0625$. $\forall n \geq n_0$.

Hence, we have $\frac{k_2}{n} + \frac{k_3}{n^2} \leq 1$ is true $\forall n \geq n_0$.

which implies $k_1 n^2 + k_2 n + k_3 = O(n^2)$ is true

3. $3^n = O(2^n)$; $3^n \leq c \cdot 2^n$.

using Logarithm : $n \ln 3 \leq \ln c + n \ln 2$.

$n \leq \frac{\ln c}{\ln 3 - \ln 2}$, so for any c, $\forall n > \frac{\ln c}{\ln 3 - \ln 2}$

the statement $3^n \leq c \cdot 2^n$ won't be true.

Therefore, $3^n = O(2^n)$ is incorrect / False.

4. $0.001 \cdot n \cdot \log(n) - 2000 \cdot n + 6 \leq n \cdot \log n$.

We choose, $c = 1$. $0.001 \cdot n \cdot \log n - 2000 n + 6 \leq n \cdot \log n$; $6 \leq n \cdot (2000 + 0.999 \cdot \log(n))$.

We know that n and $\log n$ are monotonous increasing for $R^+ (0, \infty)$, so we take $n_0 = 1$

and our equality would be correct $\forall n \geq n_0$.
Therefore, the statement $0.001 \cdot n \log n - 2000 \cdot n + 6 = O(n \cdot \log(n))$ is correct / true

Hashing → Hash table size = 7; function = k mod 7.
Values = 19, 26, 13, 48, 17.

1. Separate chaining :-

0	1	2	3	4	5	6
			17		26 ↓	13 ↓
					19	48.

2. Linear probing :-

0	1	2	3	4	5	6.
13	48		17.		19	26

3. Double hashing :- $h'(k) = 5 - (k \bmod 5)$

k	$h(x)$	$h'(x)$	probes.
19	5	1	5
26	5	4	2
13	6	2	6
48	6	2	1
17	3	3	3.

ACCEPTED LINK :

http://codeforces.com/group/3ZU2JJw8vQ/contest/269072/my