Definition of Big θ:

If f(n) = O(g(n)) and f(n) = Ω(g(n)), then f(n) = θ(g(n)).
f(n) = O(g(n)), if there are positive constants c and n_0 such that f(n) ≤ c * g(n) for all n ≥ n_0.
f(n) = Ω(g(n)), if there are positive constants c and n_0 such that f(n) ≥ c * g(n) for all n ≥ n_0.

11. $n^2 + n/2 + 1 = \theta(n^3)$

False, no constants can be chosen since $g(n^3) \geq f * g(n^2)$ for all c.

$f(n^2) = O(g(n^3))$ because for c = 2, $n_0 = 2$, $g(n^3) \geq f * g(n^2)$ for all $n \geq n_0$.
$f(n^2)$!= $\Omega(g(n^3))$ because for any c, $g(n^3) \geq f * g(n^2)$ for all $n \geq n_0$. Eg if $c = 5$, for all $n \geq n_0 = 5$, $g(n^3) \geq f * g(n^2)$.

12.

False, because no constants can be chosen since g(log64) ≥ f (1) for all c.

g = O(f) but f != O(g) as log64 = 6 > 1.
Likewise, g != Ω(f) but f = Ω(g) because 1 < 6.

13.

False. Because no constants can be chosen since f(nlogn) >= g(logn) for all c.

f(nlogn) = Omega(g) but g != Omega(f) because for any n, nlogn >= logn.
Likewise, f(nlogn) != O(g) but g = O(f) .

14.

False. Because no constants can be chosen since 2^n >= n for all c

15.

True since n^5/n^2 = n^3. Let c be 5 and n_0 be 5. Then 5(n^5/n^2) always > n^3.
Likewise, 5(n^3) always >= (n^5/n^2). Therefore 15 is true.