1-4. (1). $3n^2+10n=O(n^2)$

(2). $~~n^2+~~ n^2/10+2^n=O(2^n)$

(3). $21+1/n=~~10~~\cdot O(1)$

(4). $\log n^3=O(\log n)$

(5). $10\log 3^n=O(n)$

1-9.

(1). $f(n)=\log n^2=\Theta(\log n+5)$

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

~~$\exists c_1 7 n_1$, 当 $n 7 n_1$,~~

$n_1 7 0$

$\exists c_1 72$, 当 $n 7 n_1$, $f(n)<c_1(\log n+5)$

$\exists c_2<2, n_2 70$, 当 $n>n_1$ $c_2(\log n+5)<f(n)=2\log n$

$\therefore f(n)=\Theta(g(n))$

(2). $f(n)=O(\sqrt{n})$

$\exists c_1, n_1$, 当 $n>n_1$, $f(n)<c_1 g(n)$

$\therefore f(n)=O(\sqrt{n})=O(g(n))$

(3). $f(n)=n=\Omega(\log^2 n)$

$\exists c_1, n_1$, 当 $n 7 n_1$, $n 7 c_1(\log^2 n)$

(4). $f(n)=n\log n+n=\Omega(\log n)$

$\exists c_1, n_1$, 当 $n>n_1$, $n\log n+n > c_1\log n$

(5). $f(n)=10=\Theta(\log 10)$

$\exists C_1 > \frac{10}{\log 10}$, $10 < C_1 \cdot \log 10$

$\exists 0 < C_2 < \log 10$, $10 > C_2 \log 10$

$\therefore f(n) = \Theta(g(n))$

(6). $f(n) = \log^2 n = O(\log n)$

$\exists C_1 > 0$, n_1, 当 $n > n_1$, $\log^2 n > C_1 \log n$.

(7). $f(n) = O(g(n))$

$\exists C_1 > 0$, n_1, 当 $n > n_1$, $2^n > 100 C_1 n^2$

(8). $f(n) = \Omega(g(n))$

$\exists C_1 > 0$, n_1, 当 $n > n_1$, $2^n < C_1 3^n \Rightarrow C_1 > (\frac{2}{3})^n$

1-10.

$\lim_{n \to \infty} \frac{n!}{n^n} = \lim_{n \to \infty} \frac{n}{n} \cdot \frac{n-1}{n} \cdot \frac{n-2}{n} \cdots \frac{1}{n} = 0$

$\therefore \exists C_1, n_1$, 当 $n > n_1$, $n! < C_1 n^n$

$\therefore n! = O(n^n)$