1a. No, the runtime of 2^n is definately less than 2^{n+1} at any points. that means $2^{n+1} \notin O(2^n)$

1b. No, the runtime of 2^{2^n} is increasing more than 2^n as n goes up. that means $2^{2^n} \notin O(2^n)$
(2^n is growing faster than n as well)

1c. No, $n^{1.01}$ is linear increasing, $\log^2 n$ is increasing in logarithmic, which is far slower than linear
that means $n^{1.01} \notin O(\log^2 n)$

1d. Yes, $\log^2 n$ is asymptotically dominated by $n^{1.01}$ as just mentioned above, that means $n^{1.01} \in \Omega(\log^2 n)$

1e. No, $\sqrt{n}$ is exponential function where $\log n^3$ is logarithmic function, since exponential increase faster than logarithmic
$\sqrt{n}$ is asymptotically dominate $\log n^3$, so
$\sqrt{n} \notin O(\log n^3)$

1f. Yes, as describe above, $\sqrt{n} \in \Omega(\log n^3)$

1g. if $\exists$ $f(n) \in o(g(n))$, $f(n) \in \omega(g(n))$

$\Rightarrow$ $f(n) \leq c \cdot g(n)$ and $f(n) \geq c \cdot g(n)$

for every $c > 0$, that means $c \cdot g(n) < f(n) < c \cdot g(n)$

which is impossible

the set of it should be empty

2b. Find out the $(x+1)^{th}$ number in the fibonacci sequence

3b. work $= O(n) + C$

span $= O(n) + C$

3d. work $=$ $O(2 \lg n) + C$

span $=$ $O(\lg n) + C$

3f. work $=$ $O(2 \lg n) + C$

span $=$ $O(\lg n) + C$