Problem 1: parts 2 and 3
$T(n)=T(n-1)+n$
$T(n-1)=T(n-2)+n-1$ $T(n-2)=T(n-3)+2n-2$
$T(n)=T(n-3)+3n-3$
.
.
.
$=T(n-n)+n*n-n$
$=T(0)+n*n-n$
$=c+n^2-n$
$O(n^2)$

Problem 2
$\log_a n=\log_b n$
$\log_b n=\log_a n/\log_a b \rightarrow \log_a b$ is a constant
$\log_a n/\log_a b= \log_a n*(1/\log_a b)= c*\log_a n$
$\log_b n=c*\log_a n$

$c*\log_a n <= \log_b n <= c*\log_a n$

Problem 4:
best case
$T(n)=2T(n/2)+cn$ $T(n/2)=2T(n/4)+cn$
$T(n)=4T(n/4)+2cn$
$=8T(n/8)+3cn$
.
.
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$=nT(n/n)+cn(\log_2 n)$
$=n+cn(\log_2 n)$
$O(n\log_2 n)$

worst case
$T(n)=T(n-1)+n$
$T(n-1)=T(n-2)+n-1$ $T(n-2)=T(n-3)+2n-2$
$T(n)=T(n-3)+3n-3$
.
.
.
$=T(n-n)+n*n-n$
$=T(0)+n*n-n$
$=c+n^2-n$
$O(n^2)$