Minimal HW

Problem 1:

Given $n=2^m$

$$O(n) = n \times log(n) \times (1 + 2 + ... + n) = n^2 log(n) = n^2$$

Substitute n with 2^m : $O(n)=(2^m)^2log(2^m)=m4^m=4^m$

Problem 2:

 $f(n) = \theta(f(n/2))$ is always true or false.

Counterexample: let $f(n)=2^n$ then $f(n/2)=2^{n/2}=\sqrt{2^n}$ which is false.

Problem 3:

$$T(n) = aT(n/b) + heta(n^k log^p n)$$

a.
$$T(n)=5T(n/3)+nlog(n)
ightarrow a=5, b=3$$
 where $a>b$ then $T(n)= heta(n^{log_35})$

b.
$$T(n)=3T(n/3)+n/log(n) o a=3, b=3$$
 where $a=b$ then $n^{log_33}=n.\ p=-1$ then $T(n)= heta(nloglog(n))$

c.
$$T(n)=8T(n/2)+n^3\sqrt{n}
ightarrow n^{log_28}+n^{3.5}$$
 then $T(n)= heta(n^{3.5})$

d.
$$T(n)=2T(n/2-2)+n/2
ightarrow n^{log_22}+1/2n$$
 then $T(n)= heta(n)$

e.
$$T(n)=2T(n/2)+n/log(n)
ightarrow n^{log_22}+nlog^{-1}n$$
 then $T(n)= heta(nloglogn)$

f.
$$T(n)=T(n/2)+T(n/4)+T(n/8)+n o n^{log_21}+n^{log_41}+n^{log_81}+n$$
 then $T(n)= heta(3+n)= heta(n)$

g.
$$T(n) = T(n-1) + 1/n o 1/n$$
 limits to 0 then $T(n) = T(n-1) = heta(log n)$

h.
$$T(n) = T(n-1) + logn
ightarrow T(n) = heta(nlogn)$$

i.
$$T(n) = T(n-2) + 1/logn
ightarrow T(n) = heta(n/logn)$$

j.
$$T(n) = \sqrt{n}T(\sqrt{n}) + n \rightarrow T(n) = \theta(nloglogn)$$