Homework 3: Advanced Algorithms

Problem 1:

For each of the following recurrences, decide whether the Master Theorem (as in the book, not as in Wikipedia) can be applied and if yes, then apply it. Show your work. In particular, identify f, a, b.

(a) $T(n) = 3T(n/2) + n$

(b) $T(n) = \frac{2}{3}T(n/2) + \frac{1}{3}n$

(c) $T(n) = 5T(n/7) + n\cos(n\pi)$

(d) $T(n) = 4T(\frac{n}{16}) + 2^n$

(e) $T(n) = 2T(\frac{n}{2}) + 2n\log(n)$

Problem 2:

Read the following articles (available from within the Marquette network):

Comer, Douglas. "Ubiquitous B-tree." *ACM Computing Surveys (CSUR)* 11.2 (1979): 121-137.
Lomet, David. "The evolution of effective b-tree: Page organization and techniques: A personal account." *ACM SIGMOD Record* 30.3 (2001): 64-69.

Explain in your own words the purpose of compressing key entries in a B-tree node. Sketch an implementation of a B-tree node (in pseudo-code, Python, Java, C++, C, …)

Problem 3:

(1) Show ALL the steps in deleting 'eft' from the following B-tree using the successor.
(2) Show ALL the steps in deleting 'fox' from the **resulting** B-tree using the predecessor.