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ECE 368 Spring 2016.

Homework 1

1) Explain the difference between <u>set</u>, <u>list (array or linked list)</u>, and <u>map</u>. Then fill the boxes with the container to use for each case.

Desired Task:	Container Type
Making a dictionary	
Creating a spellchecker	
Defining the possible outcomes of two dice roll	
Enqueuing printing jobs from different computers.	

2) Use induction to prove $10n < 2^n \ \forall \mathrm{n} : \mathrm{n} \geq \ n_0 \ where \ n_0 > 0$.

3) For any two functions f(n) and g(n), we say that f(n) $\sim$ g(n) if and only if

$$\lim_{n\to\infty} \frac{f(n)}{g(n)} = c(n) \text{ and } \lim_{n\to\infty} \frac{c(n)}{n} = 0$$

a. Which of these functions are related? (specify all the related pairs)

$$n\,, \sqrt{n}, logn, 5n, n^2, e^n$$

b. Is $\sim$ an equivalence relation and why?

4) Solve the following sub-problems:

a. Given a set {a, b, c, d, e, f, g, h}, how many ways can you choose 4 items

b. $\lim_{n\to\infty} \frac{1+2+\cdots+n+(n+1)}{n(n+1)} =$

$$c. \sum_{k=0}^{n^2} \left(\frac{1}{3}\right)^k =$$

5) For each function f(n) and time t in the following table, determine the largest size n of a problem that can be solved in time t, assuming that the algorithm to solve the problem takes f(n) microseconds.

f(n)	1 second	1 hour	1 day	1 year (365 days)
$\log_2 n$				
$\sqrt{n}$				
n				
$\mathrm{n}\log_2 n$				
n^2				
2^n				
$n!$				

6) Rank the following functions in ascending order of growth. (1 = slowest, 9 = fastest)

a. n^5
b. $n!$
c. $nlog_2(n)$
d. $log_2(n!)$
e. $(5log_2(n))^2$
f. $\sqrt{n}$
g. $2^{log_2 n}$
h. $n^{1/log_2 n}$
i. $n2^n$

1	2	3	4	5	6	7	8	9