CSE 373 Assignment 3 Solutions

1. **(a)** f_S : INDEX × STRING × ARRAY → ARRAY
   f_S : (i, s_i, [e_0, e_1, . . . , e_i, . . . , e_{n-1}]) ↦ [e_0, e_1, . . . , s_i, . . . , e_{n-1}] where 0 ≤ i ≥ n - 1

   (b) f_S : INDEX × ARRAY → STRING
   f_S : (i, [e_0, e_1, . . . , e_i, . . . , e_{n-1}]) ↦ e_i where 0 ≤ i ≥ n - 1

2. **(a)**

	5	$10\log_2 n$	$\sqrt{n}$	$\frac{n}{100}$	50n	$n\log_2 n$	$2n^2$	$100n^2$	1.01^n	n!
f(n) = 5	ΘO	O	O	O	O	O	O	O	O	O
f(n) = $10\log_2 n$	ΩΘ	O	O	O	O	O	O	O	O	O
f(n) = $\sqrt{n}$	ΩΩ	Θ	O	O	O	O	O	O	O	O
f(n) = $\frac{n}{100}$	ΩΩ	Ω	Θ	Θ	O	O	O	O	O	O
f(n) = 50n	ΩΩ	Ω	Θ	Θ	O	O	O	O	O	O
f(n) = $n\log_2 n$	ΩΩ	Ω	Ω	Ω	Θ	O	O	O	O	O
f(n) = $2n^2$	ΩΩ	Ω	Ω	Ω	Ω	Θ	Θ	O	O	O
f(n) = $100n^2$	ΩΩ	Ω	Ω	Ω	Ω	Θ	Θ	O	O	O
f(n) = 1.01^n	ΩΩ	Ω	Ω	Ω	Ω	Ω	Ω	Θ	O	O
f(n) = n!	ΩΩ	Ω	Ω	Ω	Ω	Ω	Ω	Ω	Θ	Θ

   (b) The function $n\log_2 n$ is $O(2n^2)$
   Justification: Using the knowledge that logn < n for n ≥ 1 we can multiply both sides of the equation by n to get nlogn < n^2. Since we know this to be true we can multpiply by any constant c(like 2 in our case) such that nlogn will always be $O(2n^2)$.

   (c) The function $2n^2$ is $\Theta(100n^2)$
   Justification: We need to find a c' and a c" such that c'g(n) ≤ f(n) ≤ c"g(n) for n ≥ n_0. If we set c' to $\frac{1}{50}$ and c" to 1 then we can show that indeed, $2n^2 \leq 2n^2 \leq 100n^2$ for n ≥ 1. Therefore $2n^2$ is $\Theta(100n^2)$.