70087 ExerciseTypes.CW1

Coursework 1

Submitters

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9/10. Good work. Well done.

Emarking

CW1

(a)
A best case input is any array A that the first element in A does not equal to x. Or A is an empty array. An example of this case is that x=1 and A= [2,1].
$T_{COUNTWHILE}(N)=c$, where c is a positive constant. So $T_{COUNTWHILE}(N)=\Theta(1)$.
A worst case input is any array A that each element in A equals to x. An example of this case is that x=1 and A= [1, 1,...,1].
$T_{COUNTWHILE}(N)=aN+b$, where a, b are positive constants. So $T_{COUNTWHILE}(N)=\Theta(N)$.

2

(b)

Not 1. Use some constant, c.

$T_{cf}(N)=1$ if N=0
$T_{cf}(N) = T_{cf}(N-1) +d$ if N>1

1

(c)
For the worst case, $T_{cf}(N) = T_{cf}(N-1) + d$ if N>1 (a)
$T_{cf}(N-1) = T_{cf}(N-2) + d$ if N>2 (b)
Replace $T_{cf}(N-1)$ in formula (a) with the definition in (b), we gain the following formula.
$T_{cf} = T_{cf}(N-2) + 2d$
By continuing, we can extract a general form $T_{cf}(N) = T_{cf}(N-i)$ +id   if N>i>1
Setting i=N-1, we have $T_{cf}(N)=T_{cf}(1) + (N-1)d$ if N>1
Since $T_{cf}(1)$ is a constant, $T_{cf}(N)= \Theta(N)$.

2

(d)
For a best case input, $T_{cw}(N)= \Theta(1)$.
For a worst case input, $T_{cw}(N)= \Theta(N)$.
So, $T_{cw}(N)= \Omega(1)$
       $T_{cw}(N)= O(N)$
       There is no Θ bound because the time complexity is different depending on the input.

2

(e)
For the upper bound, the recursive function will be called a maximum time. $A_{cw}(N)= \Theta(N)$.
For the lower bound, it reflects the minimal space needed for a single non-recursive call.
$A_{cw}(N)= \Theta(1)$.
So, $A_{cw}(N)= \Omega(1)$
       $A_{cw}(N)= O(N)$

2