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1. (a) F

(b) T

(c) T

(d) T

(e) F

(f) F

(g) F

(h) T

(i) F

(j) T

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2. (a) B

(b) B

(c) C

(d) B

(e) D

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3. (a) ACD

(b) AC

(c) D

(d) BCD

(e) C

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4. (a) i. S - A - B - D - T

ii. S - A - B - C - D - T

(b) i. α) S - A - B - C - D - T

β) S → A → C → T 4

ii α) S - A - C - D - T

β) S → A → C → T 4

γ) both admissible and consistent

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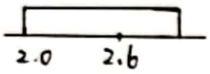
. (a) let the unit-interval start at the given points

① if the next given point has been included in the former unit-interval then there is no need to cover a new unit-interval

i.e.



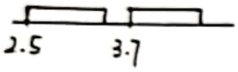
2 points are 2.0 and 2.6

the only unit-interval is [2, 3]

② if the next given point is not in the former unit-interval then we need 2 new unit-interval seperately.

i.e.

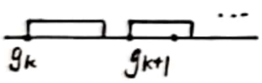
2 points are 2.5 and 3.7



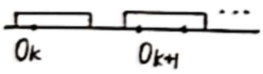
we need two unit-interval [2.5, 3.5] [3.7, 4.7]

(b) suppose g_i, O_i are the i-th unit-interval in greedy algorithm and optimal algorithm and $g_1 = O_1$, $g_2 = O_2$, $\cdots$ $g_k = O_k$ for $i \in (1, k)$. the i-th point is x_i

Greedy :



Optimal :



for $i \in (k+1, +\infty)$. $\underbrace{x_k - d_k \leq O_{k+1}}_{\text{optimal}} \leq \underbrace{x_k + d_k = g_{k+1}}_{\text{greedy}}$

it shows that the greedy algorithm may not be so feasible as the optimal algorithm but it still works optimally to find the minimum number of unit-intervals to cover all the given points.

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6. For k-color problem, it can always be reduced to the sum of 3-color problems and 4-color problems

since k can be represented as $k = n_1 \times 3 + n_2 \times 4$

where n_1, n_2 are all intergers

Since 3-color problem and 4-color problem are both in NP-Complete

k-color problem is also in NP-Complete

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7. (a) if slots $j=1,\cdots,i-1$ are all incompatible with slot i

$p(i)=0$

else

if slot $j=i-1$ is compatible with slot i

$p(i) = p(i-1)+1$

else

$p(i) = p(i-1)$

(b) $OPT(i)$ = the maximum total revenue of placing i billboards which are all compatible to each other.

(C)
$$OPT(i) = \begin{cases} r_1 & (i=1) \\ OPT(i-1) + r_{p(i)} & (i>1) \end{cases}$$

(d) $\Theta(n^2)$