

Assignment 4 Rubrics (100 points max, 110 points in total)

Q1 (10 points)

1. weak induction -> strong induction for 3pts, strong induction -> weak induction for 2 pts
2. use the size of S: -4pts

Q2 (5 points)

detailed derivation for 5 pts
if induction is not used: -4pts

Q3 (5 points)

$P(1)$ is true. 1p $P(k+1)$ is true when $p \mid a_1 a_2 \dots a_{k+1}$ 2p $P(k+1)$ is true when the condition above fails to exist. 2p

Q4 (10 points)

2p for each sub question.

Q5 (6 points)

$i > j$ 1p
 $m = (i+j)/2$ 1p
 $x = a_m$ return m 1p
 $x < a_m$ return $\text{BinarySearch}(x, i, m-1)$
 $x > a_m$ return $\text{BinarySearch}(x, i, m-1)$ 1p for each, 3p for writing both.

Q6 (6 points)

According to the completeness of the proof process, score accordingly:

- **6 points:** a complete and sufficient proof.
- **1-5 points:** Incomplete or skip proof (such as extensive use, obvious, easy to obtain, etc.) depending on the completeness of the proof.
- **0 points:** Blank, unclear handwriting, or no meaningful solution.

Q7 (8 points)

- Expand $T(n) = aT(\frac{n}{2}) + n$ to get **2 points**;
- Write in the form of a proportional sequence and score **2 points**.
- Using the sum formula of the proportional sequence, obtain the expression of $T(n)$ for **2 points**;
- After analysis, it was pointed out that it is $\Theta(n)$, earning **2 points**.

Deduction of points based on the completeness of the proof:

- Blurred handwriting, chaotic symbols: treated as not seen.
- Excessive use of non evidential language (such as obvious, easy to obtain, etc.): may deduct **1 - 2 points** for each occurrence as appropriate.

Q8 (12 points)

no process but have answer give half score.

the answer must be true otherwise -2 per subtask

- (a) 3744
- (b) 123552
- (c) 5148
- (d) 10240
- (e) 624

Q9 (5 points)

92

reason is need, value 3'

answer value 2'

Q10 (8 points)

by prove process give points.

The key point is:

First, note that $\gcd(2, 1011) = 1$, so it suffices xx (1') Second, if $a \mid c$ and $b \mid c$, then $ab \mid c$ (1')

By definition, we know $c = ak$ for some integer k . Then, from $b \mid ak$ and $\gcd(b, a) = 1$, one can conclude that $b \mid k$ and therefore $ab \mid c$. (2')

prove $2 \mid x \mid 1011 \mid x$ by normal form (4')

(If your reason is correct and I understand, though you show the factor, I will give the full points.)

Q11 (5 points)

Show the details.

Q12 (10 points)

Give characteristic equation and give the value of r : +5

Find the constants 1, 2, -1: +5

For mistakes, -1 or -2 or -3 or

Q13 (10 points)

(a) 8 points

- Point out $a \sim n \sim = \alpha \cdot 2^n$ or something like this, 2 points are given.

- Give the special solution $a_n = -n^2 - 4n - 6$ with proving or some process, 4 points are given. If you just show it without proving or some process, just give 2 points.

If you get the wrong special solution but you try doing this, 2 points are given.

- The final answer is worth 2 points.
- If you get answer like expressions of summing, it is considered that you have not simplified. In a, 2 points are deducted, in b, 1 point is deducted.

(b) 2 points

- The process of substituting a_1 to the formula is worth 1 point.
- The final answer is worth 1 points.

Q14 (10 points)

Please note that it is requested to **use generating functions** to solve this question, if you didn't use it, you can't get more than four points in this question for other right process (2 points) and the right final answer (2 points).

- Point out $G(x)$, 2 points are given
- Get $G(x) = x/(1-4x)(1-8x)$, 6 points are given. Even if you calculate wrong, if you try doing this, 3 points are given.
- The final answer is worth 2 points.

Contact

If you have any questions, contact corresponding TAs:

Q1-2 12111842 张羽乐

Q3-5 12111046 张天舒

Q6-7 12112910 罗嘉诚

Q8-10 12110416 刘家宝

Q11-12 12331240 潘凯歌

Q13-14 12110411 伍福临

Grading: 12332414 李昊洋