

Kennesaw State University

College of Computing and Software Engineering

Department of Computer Science

CS 5070, Mathematical Structures for Computer Science, Section W01

Quiz

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07/11/2025

Problem Statement

Problem of this document is to solve the following problem set.

1. Question: Determine the 10th term of the sequence defined by $(a_n = 3n + 2)$.
2. Question: Find the sum of the first 20 terms of the arithmetic sequence where the first term (a_1) is 5 and the common difference d is 3.
3. Question: Given a geometric sequence with $(a_1 = 2)$ and common ratio $(r = 3)$, find the 6th term.
4. Question: Translate the following statement into symbolic logic: "If it rains, then the ground will be wet."
5. Question: Prove by contradiction: "If (n) is an odd integer, then (n^2) is odd."

Summary / Purpose

Purpose of this document is to provide solutions to the problem set outlined in the Problem Statement section.

Solutions

1. Question: Determine the 10th term of the sequence defined by $(a_n = 3n + 2)$.

The 10th term in the sequence can be determined by plugging in for n .

$$\text{If } n = 0; a_0 = 3(0) + 2 = 2$$

$$\text{If } n = 1; a_1 = 3(1) + 2 = 5$$

$$\text{If } n = 2; a_2 = 3(2) + 2 = 8$$

...

$$\text{If } n = 10; a_{10} = 3(10) + 2 = 32$$

Therefore, the 10th term is 32.

2. Question: Find the sum of the first 20 terms of the arithmetic sequence where the first term (a_1) is 5 and the common difference d is 3.

If the terms of a sequence differ by a constant, then the sequence is an arithmetic sequence. If the initial term is 5 and the common difference, d , between the terms is 3. We can use the closed formula to determine the 20th term. Note that n here is going to be 19 because we already have the initial term, thus equaling 20 terms

$$a_n = a + d * n$$

$$a_{20} = 5 + 3 * (20 - 1)$$

$$a_{20} = 62$$

Now, we can use the technique of reversing and adding to get the sum of the sequence.

$$2S = 20 * (62 + 5)$$

$$S = \frac{1340}{2}$$

$$S = 670$$

Therefore, the sum of the first 20 terms is 670.

3. Question: Given a geometric sequence with ($a_1 = 2$) and common ratio ($r = 3$), find the 6th term.

A sequence is called geometric if the **ratio** between successive terms is constant. For this geometric sequence, we know the initial term is 2 and the common ratio, r , is 3. We can use the closed formula to determine the 6th term. Note again that n here is 5 since we already have the initial term.

$$a_n = a * r^n$$

$$a_6 = 2 * 3^{(6-1)}$$

$$a_6 = 486$$

Therefore, the 6th term is 486.

4. Question: Translate the following statement into symbolic logic: "If it rains, then the ground will be wet."

Suppose we have two propositions, P and Q . This statement can be broken down into two propositions and can translate to an implication. We can write this this way:

P = it rains

Q = the ground is wet

Therefore, an implication can be made such that

$$P \rightarrow Q$$

If it rains \rightarrow the ground will be wet

5. Question: Prove by contradiction: "If n is an odd integer, then n^2 is odd."

A proof by contradiction is when we prove that the statement is true by proving the negation of the proposed implication is false. Here we can say that P is if n is an odd integer, and Q is that n^2 is odd. So, we try to prove the following is true: if n is an odd integer, then n^2 is even.

Suppose n is an odd number, then $n = 2k + 1$ for some integer k . Then we can see that $n^2 = (2k + 1)^2 = 4k^2 + 4k + 1 = 2(2k^2 + 2k) + 1$. Here we can see that $(2k^2 + 2k)$ is just an integer, so let's call it m . Then $n^2 = 2m + 1$, which we can see is odd. Therefore, n^2 must be odd if n is odd.

References

- [1] Garrido, J. (2021, August 14). *CS5070 Mathematical Structures for Computer Science - Notes* [Slide show; Powerpoint]. D2L.
- [2] Kennesaw State University, College of Computing and Software Engineering, Department of Computer Science, Mathematical Structures for Computer Science. (n.d.). Quiz.
- [3] Levin, O. (2016). *Discrete mathematics: An Open Introduction*.