

PRACTICE MIDTERM EXAMINATION

Problem 1. (_____/ 15 points)

Consider the sequence

0, 3, 8, 15, 24,

1. What is the next term in the sequence?
2. Determine the recursive formula for the sequence. (Don't forget the starting value!)

3. Determine the closed formula for the sequence.

Problem 2. (_____/ 5 points)

Express the sum

$$3 + 6 + 9 + 12 + 15 + 18$$

using sigma-notation.

Problem 3. (_____/ 5 points)

Evaluate the sum

$$\sum_{i=1}^5 (3i + 2)$$

Problem 4. (_____/ 10 points)

Draw Venn diagrams that illustrate following operations:

1. $A \cap B$.
2. $(A \cap B)^c$.

(That's two different Venn diagrams.)

Problem 5. (_____/ 20 points)

Let

$$A = \{2, 3, 5, 7, 11\}$$

$$B = \{2, 4, 6, 8, 10\}$$

$$C = \{1, 3, 5, 7, 9\}$$

Determine the following:

1. $A \cap B$

2. $(A \cap B) \cup C$

3. $(A \cup B) \cap C$

4. $A - B$

5. $|\mathcal{P}(B)|$

Problem 6. (_____/ 10 points)

In a recent survey, 25% of the respondents said that we should raise taxes, 40% said that we should cut the Federal budget, and 55% said that we should do one or the other (perhaps both). What percentage of the respondents said that we should both raise taxes *and* cut the Federal budget?

Problem 7. (_____/ 5 points)

Suppose that you (or somebody else) has proved that the propositional equivalence

$$p \wedge (\neg q \vee r) \equiv (p \wedge \neg q) \vee (p \wedge r)$$

is true. The duality principle tells us that the dual of this equivalence is also true. What is the dual of the equivalence given above?

Problem 8. (_____/ 10 points)

Draw the parse tree of the expression

$$p \wedge q \Rightarrow p$$

Problem 9. (_____/ 15 points)

Let the variables f , s , and p stand for “the food is good”, “the service is excellent”, and “the price is high”, respectively. Translate the following English sentences into propositional form.

1. Either the food is good or the service is excellent.
2. The food is good and the service is excellent.
3. The food is good, but the service is not excellent.
4. Either the food is good and the service is excellent, or else the price is high.
5. If the price is high, then the food is good and the service is excellent.

Problem 10. (_____/ 15 points)

Use a truth table to prove DeMorgan’s Law

$$\neg(p \wedge q) \equiv (\neg p) \vee (\neg q)$$