

國立成功大學  
114學年度碩士班招生考試試題

編 號：127

系 所：電機工程學系

科 目：離散數學

日 期：0210

節 次：第 3 節

注 意：1.不可使用計算機  
2.請於答案卷(卡)作答，於  
試題上作答，不予計分。

**Multiple-choice questions on discrete mathematics. For each question, you need to write down your answer and reason.**

**1. (10%) Which of the following is NOT a proposition?**

(a) The Earth is flat. (b)  $2 + 2 = 4$  (c)  $x + 5 = 10$  (d) The sky is blue.

**2. (10%) Let  $P(x)$  be the statement “ $x$  is a prime number”. What is the truth value of  $\exists x (P(x) \wedge \neg P(x+2))$ ? Assume the domain is the set of positive integers.**

(a) True (b) False (c) Cannot be determined (d) Undefined

**3. (10%) What is the coefficient of  $x^5y^3z^2$  in the expansion of  $(x + 2y - z)^{10}$ ?**

(a) -2520 (b) 2520 (c) 7560 (d) -7560

**4. (10%) You have a set of 100 distinct integers. What is the minimum number of integers you must select to guarantee that at least two integers have a difference that is divisible by 17?**

(a) 18 (b) 19 (c) 34 (d) 35

**5. (10%) Which is an example of a relation that is reflexive, symmetric, and transitive?**

(a) " $<$ " on the set of integers (b) " $\neq$ " on the set of integers (c) " $=$ " on the set of integers (d) " $|$ " (divides) on the set of positive integers

**6. (10%) Solve the recurrence relation  $a_n = 3a_{n-1} - 2a_{n-2}$  with initial conditions  $a_0 = 2$  and  $a_1 = 7$ . Find a general formula for  $a_n$  and then calculate  $a_5$ .**

(a) 243 (b) 242 (c) 727 (d) 728

**7. (10%) Consider a simple, connected, undirected planar graph with 8 vertices. What is the *maximum* number of edges it can have? (Consider Euler's formula for planar graphs:  $V - E + F = 2$ , where  $V$  is vertices,  $E$  is edges, and  $F$  is faces.)**

(a) 12 (b) 16 (c) 20 (d) 24

**8. (10%) A binary search tree (BST) is constructed by inserting the following numbers in order: 8, 3, 10, 1, 6, 14, 4, 7, 13. What is the height of the BST?**

(a) 2 (b) 3 (c) 4 (d) 5

**9. (10%) How many distinct permutations are there of the letters in the word "BOOKKEEPER"?**

(a)  $9!$  (b)  $9!/(2!2!3!)$  (c)  $10!/2!$  (d)  $9!/3!$

**10. (10%) Using Dijkstra's algorithm, find the shortest path from node A to node E in the following weighted graph: A-B(4), A-C(2), B-D(1), C-D(5), C-E(3), D-E(2). (The numbers indicate the weight of the edge.)**

(a) A-B-D-E (b) A-C-E (c) A-C-D-E (d) A-B-C-E