POKHARA UNIVERSITY

Level: Bachelor | Semester: Spring | Year : 2025

Programme: BE | Full Marks : 100

Course: Problem Solving Techniques (New) | Pass Marks : 45

Time : 3 hrs

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Attempt all the questions.

1. a) In PST class there are k students in the class. If K is even number then number of handshakes then will be the even or odd? If K is odd then will the number of handshakes will that takes place be even or odd? 7

   b) There are most adults than boys, more boys than girls, more girls than families. If no family has fewer than 3 children, ten what is the least number of families there could be? 8

2. a) Initiate the method for finding the formula for the sum of first k odd positive integer. 7

   b) A right-angled triangle has sides of length l, m, 10. Note that 10 is not the hypotenuse, and the both and m are integers. From this information, find l, m. 8

   OR

   Show that if the diagonals of a quadrilateral are perpendicular then sum of squares of one pair of opposite side of the quadrilateral equal the sum of squares of other pair of opposite sides.

3. a) Explain why it is impossible to have a polyhedron with 6 triangular faces meeting at each vertex. 7

   b) Solve the crypto arithmetic problem:

   NINA+SING=AGAIN 8

   OR

Draw an 8*8 magic square such that each row, each column and each diagonal add up to the same number. Explain in detail the process you used to draw such 8*8 magic square.

4. a) A ten-foot pole is dropped into a milling saw and randomly cut into three shorter poles. What is the probability that these three pieces will form a triangle. 7

   b) A game is played by two players. They begin with pile of 43 chips, all the same. For his or her move, a player may remove 2 to 8 chips. The player who removes the last chip wins. What strategy can the first players use so that he will always win. 8

5. a) Six people, named A, B, C, D, E, F are in the dining car of a train. They are one each from New York City, Chicago, Tulsa, St. Louis, Milwaukee and Atlanta. The following facts are known. 7

   i. A and the man from New York City are physicians.
   ii. E and the woman from Chicago are teachers.
   iii. The person from Tulsa and C are Engineers.
   iv. B and F are veterans of Gulf war, but the person from Tulsa has never served in the military.
   v. The person from Milwaukee is older than A
   vi. The person from Atlanta is older than C.
   vii. At St. Louis, B and the man from New York get off.
   viii. At San Francisco, B and the man from Milwaukee gets off.

6. a) There is two married couple that needs to cross the river. A small boat is available that will hold just two people at a time. The males involved are quite jealous. No woman can be left with a man unless her husband is also present. There are no other constraints. How can these four people cross the river? What is the fewest number of trips possible? 8

   b) Imagine the election involving three candidates A, B, C. There are 33 Votes. All voters vote and every voter gives near ranking to three candidates. The result is shown below.

Ranking	Number of Votes
ABC	10
ACB	4
BAC	2
BCA	7
CAB	3
CBA	7

We have three methods namely plurality method (who get the most votes in Winner). Borda method (candidates with best average Is winner) and Hare method (fewest votes' candidates is eliminated and votes are shared to second rank candidate method). Show that which method favors which of the candidates. 7

7. Write short notes on: (Any two) 2x5
   a) Mathematical Induction for 7^n-1 is divisible by 6.
   b) Explain impossible problems.
   c) Magic square

POKHARA UNIVERSITY

Level: Bachelor Semester: Fall Year : 2023
Programme: BE Full Marks: 100
Course: Problem Solving Techniques (New) Pass Marks: 45
Time : 3 hrs.

Candidates are required to give their answers in their own words as far as practicable.
The figures in the margin indicate full marks.
Attempt all the questions.

1. a) In a PST class there are K students. At the beginning of each class hour, each student shakes hands with each of the other students. If K is even, then what will the number of handshakes that takes place be even or odd? If K is odd, then will the number of handshakes that takes places be even or odd? 8
   b) Derive the sum of first k square positive integer. 7
2. a) Explain why it is impossible to have a polyhedron with 6 triangular faces meeting at each vertex? 8
   b) The perimeter of a certain right triangular is 60 inches. The height perpendicular to the hypotenuse is 12 inches. What is the length of the three sides of the triangle? 7

   OR

   Develop and expression as a formula to find out area of a triangle using only the lengths of the triangle's three sides.
3. a) A ten-foot pole is dropped into a milling saw and randomly cut into three shorter poles. What is the probability that these three pieces will form a triangle? 7
   b) Suppose that you have 9 pearls. They all look the same, but 8 of have equal 8 weight and one is different. The odd pearl is either heavier or lighter; you do know which. The only equipment that you have at hand is a balance scale. How can you use the scale to find the odd pearl in just three weighing? 8
4. a) A game is played by two players. They begin with a pile of thirty chips, all the same. For his or her move, a player may remove 1 to 6 chips. They player who removes the last chip wins. What strategy can the first player use so that he always win? 7

   OR

   Solve the crypto arithmetic problem. ***CROSS + ROADS = DANGER***
   b) Six people, named A, B, C, D, E, F are in the dining car of a train. They are one each from New York City, Chicago, Tulsa, St. Louis. Milwaukee and Atlanta. The following facts are known. 8
   i. A and the man from New York City are physicians.
   ii. E and the woman from Chicago are teachers.
   iii. The person from Tulsa and C are engineers.
   iv. B and F are veterans of Gulf war, but the person from Tulsa has never served in the military.
   v. The person from Milwaukee is older than A
   vi. The person from Atlanta is older than C
   vii. At St. Louis, B and the man from New York get off.
   viii. At San Francisco, C and the man from Milwaukee get off.
5. a) There are two marries couples that need to cross a river. A small boat is available that will hold just two people at a time. The males involved are quite jealous. No woman can be left with a man unless her husband is also present. There are no other constraints. How can these four people cross the river? What is the fewest number of trips possible? 8
   b) A martini is made by mixing k parts gin with 1 part vermouth. Gin is usually 40% alcohol while vermouth is 20% alcohol. A martini is said to be dry if it contains relatively little vermouth. For instance, if k = 15 then the martini is said to be dry. If instead k = 5, then the martini is said to be sweet. Discuss by calculating the amount of alcohol in a dry martini vs sweet martini, which one is better? 7
6. a) A certain number k is a multiple of 9. Add the digits together. If the result has more than one digit, add those together. Continue adding digits together until you have a one-digit answer. It will be a 9. Explain why this is so? 8
   b) A cube of a side r is inscribed in a sphere. The sphere is inscribed in a cone with side length equal to the diameter of its base. The cone is inscribed in a right circular cylinder. What is the surface area of the cylinder? 7
7. Write short notes on: (Any two) 2x5
   a. Explain impossible Problems.
   b. The following sequence has become known as the John H. Conway sequence. Determine the next term of the sequence.
   1, 1, 1, 3, 4, 1, 1 ,3, 6, 1, 2, 3, 1, 4, 8, 1, 3, 3, 2, 4, 1, 6 ?
   c. Which is greater sin(cos x) or cos(sin x)?

POKHARA UNIVERSITY

Level: Bachelor Semester: Spring Year : 2024
Programme: BE Full Marks: 100
Course: Problem Solving Techniques (New) Pass Marks: 45
Time : 3 hrs.

Candidates are required to give their answers in their own words as far as practicable.
The figures in the margin indicate full marks.
Attempt all the questions.

1. a) Explain why there are infinitely many prime numbers. 7
   b) Assume that k is a positive integer: if (k+1) letters are delivered to k mailboxes, then show that one mailbox contain at least one letters. 8
2. a) A right circular cone has a cube inscribed in it. If the radius of the cone is 1, and its height is 3, then what is the volume of the cube? 8

   OR

   Of all parallelograms with a given perimeter, which has the greatest area?
   b) Let l and m be two lines in the plane that are skew to each other (i.e. they intersect at a single point X). Let P be a point (other than X) on the line l. Using a ruler and compass, construct a circle that is tangent to both lines and passes through P. 7
3. a) Suppose that you have 37 envelopes and you address 37 letters to go with them. Closing your eyes, you randomly stuff one letter into each envelope. What is the probability that precisely two letters are in the wrong envelopes and all others in the correct envelope? 7
   b) Solve the following crypto arithmetic problem: 8

$$\begin{array}{r} SEVEN \\ +EIGHT \\ \hline TWELVE \end{array}$$

4. a) Suppose that you have 9 pearls. They all look the same, but 8 of have equal weight and one is different. The odd pearl is either heavy or lighter; you do not know which. They only equipment that you have at your hand is a balance scale. How can you use the scale to find odd pearl in just three weighing? 8

   OR

   Develop the strategy and write an algorithm for an 8 x 8 magic square and construct it.
   b) Solve the "Tower of Hanoi" puzzle of four discs. 7
5. a) There are two married couples that need to cross a river. A small boat is available that will hold just two people at a time. The males involved are quite jealous. No woman can be left with a man unless her husband is also present. There are no other constraints. How can these people cross the river? What is the fewest numbers of trips possible? 8
   b) A new car is equipped with 3 fuel saving devices. Device A by itself save 40% on fuel; device B itself save 35% on fuel; device C by itself save 25% on fuel; now supposed that the three devices used together and they act independently. Will the combination save 40+35+25=100% on fuel? 7
6. a) A martini is made by mixing k parts gin with 1 part vermouth. Gin is usually 40% alcohol while vermouth is 20% alcohol. A martini is said to be dry if it contains relatively little vermouth. For instance, if k = 15 then the martini is said to be dry. If instead k = 5, then the martini is said to be sweet. Discuss by calculating the amount of alcohol in a dry martini vs sweet martini, which one is better? 7
   b)
   i. Prove that: $2 < \frac{1}{log_2 \pi} + \frac{1}{log_5 \pi}$.
   ii. Show that: $|cosx + sinx| \leq 2$. 8
7. Write short notes on: (Any two) 2x5
   a. Explain why it is impossible to have a polyhedron with six triangular faces meeting at each vertex?
   b. Develop 5x5 magic square.
   c. The sequence 1,1,1,3,1,4,1,1,3,6,1,2,3,1,4,8,1,3,3,2,4,1,6, a, b, c is John H. Conway sequence. Determine the values of a, b, c.

POKHARA UNIVERSITY

Level: Bachelor Semester: Fall Year : 2022
Programme: BE Full Marks: 100
Course: Problem Solving Technique (New) Pass Marks: 45
Time : 3 hrs.

Candidates are required to give their answers in their own words as far as practicable.
The figure in the margin indicates full marks.
Attempt all the questions.

1. a) A certain number k is a multiple of 9. Add the digits together. If the result has more than one digit, add those together. Continue adding digits together until you have a one-digit answer. It will be a 9. Explain why this is so? 8

OR

A watermelon weighs 500 pounds. It turns out that 99% of the weight of the watermelon is due to water in the watermelon. After the watermelon has sat in a drying room for a while, it turns out that it is only 98% water by weight. How much does it weigh now?

b) A ten-foot pole is dropped into a milling saw and randomly cut into three shorter poles. What is the probability that these three pieces will form a triangle? 7

2. a) A right-angled triangle has sides of length l, m, 10. Note that 10 is not the hypotenuse, and the both l and m are integers. Given this information, find l, m. 8

b) A game is played by two players. They begin with a pile of thirty chips, all the same. For his or her move, a player may remove 1 to 6 chips. The player who removes the last chip wins. What strategy can the player use so that he will always win? 7

3. a) Solve the crypto arithmetic problem: 7

NUDE + NOT + RUDE + NOR = CRUDE

b) Six people, named A, B, C, D, E, F are in the dining car of a train. They are one each from New York City, Chicago, Tulsa, St. Louis. Milwaukee and Atlanta. The following facts are known. 8

i. A and the man from New York City are physicians.
ii. E and the woman from Chicago are teachers.
iii. The person from Tulsa and C are engineers.
iv. B and F are veterans of Gulf war, but the person from Tulsa has never served in the military.
v. The person from Milwaukee is older than A
vi. The person from Atlanta is older than C
vii. At St. Louis, B and the man from New York get off.
viii. At San Francisco, C and the man from Milwaukee get off.

4. a) Consider a unit cube with four of its eight vertices joined to form a regular tetrahedron with vertices A, B, C, and D. What is the ration of the surface area of the cube to the surface area of tetrahedron? 7

b) A 10 years old child puts Rs. 100000 in the bank. She intended with withdraw the money on her 21st birthday. Which one scheme is better for her? 8

i. An account with 5% interest compounded daily.
ii. An account with 5.1% interest compounded weekly.

5. a) Suppose that you have 9 pearls. They all look the same, but 8 of have equal 8 weight and one is different. The odd pearl is either heavier or lighter; you do know which. The only equipment that you have at hand is a balance scale. How can you use the scale to find the odd pearl in just three weighing? 8

b) It begins snowing some time before noon. The snow fall steadily, when measured by the rate of change of depth. At exactly noon, a snow plow begins working at a steady rate (in terms of cubic feet of snow removed per hour). The plow clears two blocks during the first hour of work, and one block during the second hour. At what time did it begin snowing? 8

OR

$$1 = 1$$
$$2 + 3 + 4 = 1 + 8$$
$$5 + 6 + 7 + 8 + 9 = 8 + 27$$
$$10 + 11 + 12 + \ldots + 16 = 27 + 64$$

Determine the pattern and prove the identity.

6. a) There are three married couples that need to cross a river. A small boat is available that will hold just two people at a time. The males involved are quite jealous. No woman can be left with a man unless her husband is also present. There are no other constraints. How can these six people cross the river? What is the fewest numbers of trips possible? 7

b) Imagine the election involving three candidates A, B, C. There are 33 votes. Every voters vote and every voter gives a near ranking to the three candidates. There result is shown below. 8

Ranking	Number of Votes
ABC	10
ACB	4
BAC	2
BCA	7

CAB	3
CBA	7

We have three methods namely Plularity method (who gets most votes in Winner), Borda Method (Candidates with best average is winner) and Hare method (fewest vote candidates is eliminated and votes are shared to second rank candidate method). Show that which method favors which of the candidates.

7. Write short notes on: (Any two)
    a. Explain impossible problems
    b. Determine how many zeroes end the number 780! – 310!.
    c. Is 10^1/10 > 2^1/3 ?