

# POKHARA UNIVERSITY

Level: Bachelor

Semester: Fall

Year : 2014

Programme: BE

Full Marks: 100

Course: Problem Solving Technique

Pass Marks: 45

Time : 3hrs.

*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) Derive the sum of first K square positive integer. 8
- b) There are M number of Pigeons holes and (M+1) number of Pigeon. Verify that one Pigeonhole must contain at least two Pigeons. 7
2. a) Prove the cosine law:  $|BC|^2 = |AB|^2 + |AC|^2 - 2|AB||AC|\cos \alpha$  8
- b) How many digits are used to number the pages of a book having 100 pages numbered from 1 to 100? 7
3. a) A 10 feet pole is randomly cut into 3 pieces. Work out the probability that the 3 pieces will form a triangle. 7
- b) Solve the given crypto-arithmetic, where \* represent any digits. 8

$$\begin{array}{r} \cdot \cdot 9 \\ \times \quad 6 \\ \hline \end{array} \quad \begin{array}{r} 8 \cdot \cdot \cdot \\ \times \quad 5 \\ \hline \end{array}$$

$$\begin{array}{r} \cdot \cdot \cdot 2 \\ \times \quad 9 \\ \hline \end{array} \quad \begin{array}{r} \cdot \cdot \cdot 4 \\ \times \quad 4 \\ \hline \end{array}$$

$$\begin{array}{r} \cdot \cdot \cdot \cdot \cdot \end{array}$$

- 
4. a) Explain the process of creating magic square of  $5 \times 5$  using rolling method with example. 7
  - b) Prove:  $\cos(\alpha/2) \cdot \cos(\alpha/4) \cdot \cos(\alpha/8) = \frac{\sin(\alpha)}{8 \sin(\alpha/8)}$  8
  5. 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". Now compare the percentage of alcohol in dry martini and sweet martini.

- b) Write any three digit number. Write that three digit again adjacent to the first three number. So, you end with a six digit number. Divide that six digit number by 7, certain answer will come out. Divide the answer that you have just obtained by 11. The certain answer will come out. Divide the answer that you have just obtained by 13. Now the answer will be the three digit number which you wrote at first. Explain why this work does or happen?
6. a) Explain why, if two positive real number sum to 60, then their product cannot be 1000?  
b) A right triangle has sides of length  $l, m, 10$ . But 10 is not the hypotenuse, both  $l$  and  $m$  are integer. Find  $l$  and  $m$ .  
c) Suppose that you have another addition of encyclopedia with six volumes. The covers are  $\frac{1}{4}$ " thick, but the paper portion in each volume is  $0.8$ " thick. then how far does the worm have to crawl to get from the very first page of volume 1 to the very last page of volume 4?
7. Write short notes on: (Any two)  
a) Use of problem solving technique in computer fields  
b) Proof by Contradiction  
c) Is  $10^{1/10} > 2^{1/3}$  ?

# POKHARA UNIVERSITY

Level: Bachelor

Semester – Spring

Year : 2014

Programme: BE

Full Marks : 100

Course: Problem Solving Technique

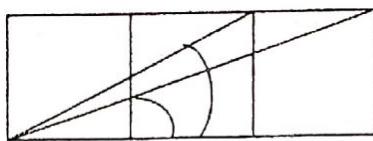
Time : 3hrs.

*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 given unit squares show that the sum of given two angle is 45 degree. 7



8

- b) A game is played by two players. They begin with a pile of 30 chips, all the same. For his or her move, a player may remove 1 to 6 chips. The player who removes the last chips wins. What strategy the first player use so that he will always win? 7
2. a) Suppose we are given a triangle ABC with base AB. Explain in detail about the constructive approach for drawing a line PQ parallel to base AB which divides the whole triangle into two equal areas. Imagine the line PQ will cut AC at a point P and BC at a point Q. 7

- b) Separate a standard deck of 52 playing cards into five piles. What is the probability that one of the top five cards is a face card (king, queen or jack)? 8

3. a) What is the greatest amount of money that you could have with denominations one paisa, five paisa, ten paisa and twenty-five paisa, such that you still could not make up an exact 50 paisa? 7

- b) Before noon, it started snowing at a constant rate (depth/hour). At noon a snow plough started to clear the snow at a constant rate (volume/hour). In the first hour snow-plough cleared two tractor of snow and in the second hour it cleared one tractor of snow, find the time when did it started snowing? 8

4. a) Solve the crypto-arithmetic problem, where different letters denote different integers and identical letters denote same integer 8

$$\text{ONE} + \text{ONE} = \text{TWO}$$

- b) Positive integers, beginning with 1, if kept continuously writing what digit of which number will be written by  $3000^{\text{th}}$  digit? 7

5. a) A small party was held at the house of Rosa. Besides Mr. and Mrs. Rosa there were five other couples present. They made a lot of handshaking to each other, but not necessarily all members with all rest of the members. Nobody shook hands with anyone twice, and 8

nobody shook hands with his/her spouse. Both host and hostess shake some hands. At the end of the party, Mr. Rosa polls each person present to see how many hands each person shook. Each person gave different answer. Determine how many hands Mrs. Rosa must have shaken.

- b) Which is greater  $1000^{1000}$  or  $1001^{999}$ ? 8
6. a) Develop an expression as a formula to find out area of a triangle using only the lengths of the triangle's three sides. 8
- b) Develop a formula for the sum of the series  $1^1 + 2^2 + 3^3 + 4^4 + \dots k^k$ . 7
7. Write short notes on: (Any Two) 5x2
- a) Use of problem solving technique in computer fields
  - b) Use of geometry in computer
  - c) Explain impossible problems

POKHARA UNIVERSITY

Year : 2015  
Full Marks: 100  
Pass Marks: 45  
Time : 3hrs.

*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. | <p>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 will the number of handshakes that takes place be even or odd? If ‘k’ is odd, then will the number of handshakes that takes place be even or odd?</p> <p>b) There are M number of Computers and <math>(M+1)</math> number of Students in a "Programming in C" Lab. Verify that one computer must be shared by at least two Students.</p> | 7      |
| 2. | <p>a) Show the sum of first K square positive integer.</p> <p>b) Draw a <math>8 \times 8</math> magic square such that each row, each column and each diagonal adds up to the same number. Explain in detail the process you used to draw such <math>8 \times 8</math> magic square.</p>   | 8<br>7 |
| 3. | <p>a) Find the number of vertex, edge and face if five triangles faces meets at each vertex.</p> <p>b) Prove the law of Sines: given a triangle <math>\Delta ABC</math> where A, B, C are vertices and a, b, c are the sides opposite to the angles.</p>   | 8<br>7 |

$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$

4. (a) Solve the Crypto arithmetic problem for:

SEND  
+MORE

- **M O N E Y**

b) To number the pages of a large book, the printer uses 1890 digits.  
How many pages are in the book? 7

- Explain the process of creating magic square of  $5 \times 5$  with example. 5
5. a) Prove:  $\cos\left(\frac{a}{2}\right) \cdot \cos\left(\frac{a}{4}\right) \cdot \cos\left(\frac{a}{8}\right) = \frac{\sin(a)}{8\sin\left(\frac{a}{8}\right)}$
- b) An efficient expert is doing a study of a certain fast food restaurant. 5  
 c) She observes that a particular clumsy waiter drops 40% of all the biscuits that he serves. What is the probability that he serves. What is the probability that he will drop exactly 3 out of 10? 5
6. a) Say that a bottle has a round or square, flat, bottom and it has straight sides. The bottle is partly full (about half) of liquid. It is tapered at the top (as bottles usually are) and has a screw on cap. How can you accurately determine the volume of the bottle if you are equipped with only a ruler? 5
- b) A new car is equipped with three fuel saving devices. Device A by itself saves 40% on fuel; device B by itself saves 35% on fuel; and device C, itself saves 25% on fuel. Now suppose that the three devices are used together and that they act independently. Will the combination save  $40+35+25=100\%$  on fuel? 5
- c) 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". Now compare the percentage of alcohol in dry martini and sweet martini. 2x5
7. Write short notes on: (Any two)
- a) Use of problem solving technique in computer fields
- b) Use of Crypto-arithmetic problem
- c) Explain impossible problems

## POKHARA UNIVERSITY

Level: Bachelor

Programme: BE

Course: Problem Solving Technique

Semester: Spring

Year : 2015

Full Marks: 100

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) Show the sum of first K square positive integer. 8  
b) Use mathematical induction to prove the following inequalities for all positive integers n.  $2^{n-1} \leq 1 + (n+1)2^n$ . 7
2. a) Consider a unit cube with four of its eight vertices joined to form a regular tetrahedron with vertices A, B, C, D. What is the ratio of the surface area of the cube to the surface area of the tetrahedron? 7  
b) The perimeter of certain right triangle is 60 inches. The height perpendicular to the hypotenuse is 12 inches. What are the length of the three sides of the triangle? 8
3. a) If a government officials offers to give you a triangular plot of land with sides 50m, 100m, 150m. Why should you not be very happy or impressed getting that land? Prove mathematically. 7  
b) A game is played by 2 players. They begin with a pile of 37 chips. For his move, a player may remove 1 to 8 chips. The player who removes the last chip wins. What strategy can a second player use so he will always win? 8
4. a) Explain the process of creating magic square of  $5 \times 5$  with example. 7  
b) Derive the largest and smallest 2-digit number which is seven times the sum of its digits. 8
5. a) A sequence:  $Z_n = (1/n) - 1/(n+1)$ . Then find the general formula or the sum  $S_m$  of the first M elements? 8  
b) Before noon, it started snowing at a constant rate (depth/hour). At noon a snow plough started to clear the snow at a constant rate (volume/hour). In the first hour snow-plough cleared two tractor of snow and in the second hour it cleared one tractor of snow, find the time when did it started snowing? 7

6. a) 5 red marbles and 4 blue marbles are placed in a bag. What is the probability that 3 of them are blue?
- b) If  $\sin x + \cos x = 1/5$  and if  $0 \leq x \leq p$  then what is the value of  $\tan 2x$ ?
- c) Suppose that you have another addition of encyclopedia with six volumes. The covers are  $1/4"$  thick, but the paper portion in each volume is  $0.8"$  thick. Then how far does the worm have to crawl to get from the very first page of volume 1 to the very last page of volume 4?
7. Write short notes on: (Any two) 2×5
- a) Why  $11^{10} - 1$  is divisible by 100.
- b) Use of geometry in computer.
- c) Probability
- d) Explain Impossible problems

# POKHARA UNIVERSITY

Level: Bachelor  
 Programme: BE  
 Course: Problem Solving Techniques

Semester: Fall

Year : 2016  
 Full Marks: 100  
 Pass Marks: 45  
 Time : 3hrs.

*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) Suppose you are told in advance that 10 of the cattles present are lame, and only have three feet. But the count yields 120 heads and 300 feet. How many cattle and how many people are there? 7
- b) An auditorium has 500 seats. The decorator has three different colours of fabric – red, blue and yellow, and will randomly upholster each seat with one of the three colours. So some will end up red, some blue, and some yellow, with no particular pattern. In how many different ways can this be done? 8
2. a) Imagine five planes in 3D space are kept in general position. Now find out into how many regions will these planes divide the space? 8
- b) To tile a floor with circular tile, which method is essential-rectangular or hexagonal way of putting the circular tiles? 7
3. a) Show that the following formula for the Fibonacci sequence is valid: 7

$$a_j = \frac{\left(\frac{1+\sqrt{5}}{2}\right)^j - \left(\frac{1-\sqrt{5}}{2}\right)^j}{\sqrt{5}}$$

- b) Examine the equation 8

$$1 = 1$$

$$1 - 4 = -(1 + 2)$$

$$1 - 4 + 9 = 1 + 2 + 3$$

$$1 - 4 + 9 - 16 = -(1 + 2 + 3 + 4)$$

Determine the pattern and prove this identity

4. a) Consider the addition problem.

LETS  
WAVE  
LATER

where different letters stand for different digits and two occurrences of letters stand for same digits. Find all digits.

- b) Which one is greater -  $\sin(\cos x)$  or  $\cos(\sin x)$ ? 7
5. a) There are four 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. Devise a crossing strategy for minimum number of trips, so that each one gets crossed. 8
- b) A 10 years old child puts \$100 in the bank. She intended to withdraw the money on her 21<sup>st</sup> birthday. Which one scheme is better for her
- i. an account with 5% interest compounded daily, or
  - ii. an account with 5.1% interest compounded weekly ?
6. a) What is the last digit of  $3^{65221}$ ? 5
- b) Consider the polyhedron with 5 triangular faces meeting at each vertex. Find number of faces, edges and vertices. 5
- c) Try to find out multi-digit number that is multiplied by the number 9 (nine) or any of its multiplication product (18, 27, 36,...) which results in the multiplication factor repeats  $n$  number of times? 5
7. Write short notes on: (Any two) 2×5
- a) Application of PST in programming
  - b) Magic square
  - c) Impossible problems

# POKHARA UNIVERSITY

Level: Bachelor

Semester: Spring

Year : 2016

Programme: BE

Full Marks: 100

Course: Problem Solving Techniques

Pass Marks: 45

Time : 3hrs.

*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) Determine how many zeros end the number $300! + 6415 \times 125^{10}$ .  | 5 |
|    | b) What is the last digit of $7^{4563}$ ?   | 5 |
|    | c) Prove by mathematical induction that $1+3^1+3^2+3^3+\dots+3^n = \frac{1}{2}(3^{n+1}-1)$ .  | 5 |
| 2. | a) Prove the law of cosines: given a triangle $\Delta ABC$ , if $\alpha$ the angle determined by sides AB and AC, then $ BC ^2= AB ^2+ AC ^2-2 AB  AC \cos\alpha$ . | 8 |
|    | b) Find the number of vertex, edge and face if polyhedron with three pentagonal faces meets at each vertex.   | 7 |
| 3. | a) There are eighty marbles all looks the same but one is lighter find it in four weighing?   | 7 |
|    | b) Examine the equations  | 8 |

$$1 = 1$$

$$1-4 = -(1+2)$$

$$1-4+9 = 1+2+3$$

$$1-4+9-16 = -(1+2+3+4)$$

Determine the pattern and prove the identity.

- |    |  |   |
|----|--|---|
| 4. | a) Solve Five disc Hanoi Problem: "There are five discs, of increasing size, on the leftmost post. The goal is to move all the discs, in the same configuration, to the right most post. There are three posts. The rules are that any disc that is on the top of any can be lifted and moved to any other post. However at no time are we allowed to place a larger disc atop a smaller disc. What is a strategy for moving all five discs to the rightmost post with the fewest movement?" | 8 |
|    | 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:  | 7 |

- i. A and the man from New York City is 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 the 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 gets off.
- Match the names of the people with their professions and their cities. 5
5. a) Calculate the sum:  $1.2.3 + 2.3.4 + 3.4.5 + \dots + n(n+1)(n+2)$ . 5  
b) In a  $4 \times 4$  array of squares, put the first sixteen odd integers 1 to 31, one in each square, so that each row and each column adds up to same number.  
c) An efficiency expert is doing study of a certain fast food restaurant. She observes that a particular waiter drops 30% of all the hamburgers that he serves. What is the probability that he will drop exactly 4 out of 10? 5
6. 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 four people cross the river? What is the fewest number of trips possible? 5  
b) Say that a bottle has a round or square, flat, bottle and it has straight sides. The bottle is partly full of water. It is tapered at the top and has a screw-on cap. How can you accurately determine the volume of the bottle if you are equipped with a ruler? 5  
c) Prove:  

$$2 < \frac{1}{\log_2 \pi} + \frac{1}{\log_\pi 2}$$
 2×5
7. Write short notes on: (Any two)  
a) Fibonacci sequence and its importance  
b) Classical planar geometry and Analytical geometry  
c) Define proof by contradiction with example

**POKHARA UNIVERSITY**

Level: Bachelor

Programme: BE

Course: Problem Solving Techniques

Semester: Fall

Year : 2017

Full Marks: 100

Pass Marks: 45

Time : 3hrs.

*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) Determine how many zeros end the number  $310! \times 2^{12} \times 5^8 + 780!$  5
- b) Show via mathematical induction that  $2^n > n^2$  for integer  $n \geq 5$ . 5
- c) If  $a, b, c, d$  are positive real numbers then show that 5  

$$\frac{(a^2+1)(b^2+1)(c^2+1)(d^2+1)}{abcd} \geq 16$$
2. a) A right angled triangle has side lengths  $a, b$  and 10 units. Note that the length 10 units is not the hypotenuse and that the lengths  $a, b$  are integers. Find the lengths  $a$  and  $b$ . 7
- b) Explain why it is impossible to have a polyhedron with six triangular faces meeting at each vertex. Explain what happens if five triangular faces meet at each vertex. 8
3. a) A cube of 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? 5
- b) Suppose that you have a 9 quart container and a 4 quart container. How can you put exactly 6 quarts of water into a large container? 5
- c) Arrange the numbers from 1 to 100 in  $4 \times 4$  magic square in such a way that sum of numbers in rows, columns and diagonals add to same result 94. 5
4. a) Game is played by two players. They begin with a pile of 35 chips, all the same. For his or her move, a player may remove 1 to 7 chips. The player who removes the last chip wins. What strategy can the first player use so that he will always win? Is there any strategy for the 8

- 7
- second player to win always?
- b) 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 lighter or heavier; you do not 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? 5
5. a) Explain why between any two rational numbers, there lies an irrational number. 5
- b) Say that a bottle has a round or square, flat, bottle and it has straight sides. The bottle is partly full of water. It is tapered at the top and has a screw-on cap. How can you accurately determine the volume of the bottle if you are equipped with a ruler? 5
- c) If  $n$  is a positive then show that  $5^n + 2 \cdot 3^{n-1} + 1$  is divisible by 8. 5
6. a) Three men and three boys need to cross a river. The only boat available will hold just one man or just two boys. Everyone is capable of rowing the boat. How can the trip be achieved, and what is the fewest number of passages needed? 5
- b) You have a piece of paper with a circle of radius between 2 inch and 4 inch drawn on it. You also have a plastic square of side 10 inches. You have no ruler and no compass. How can you find the centre of the circle? 5
- c) An Efficiency export is doing a study of a certain fast food restaurant. She observes that a particularly clumsy waiter drops 30 present of all the pizzas that he serves .What is the probability that he will drops exactly six out of fourteen ? 5
7. Write short notes on: (Any two) 2x5
- a) Need of problem solving technique
- b) Classical Planar Geometry
- c) Use of logic in river crossing problems

## POKHARA UNIVERSITY

Level: Bachelor Semester: Spring Year : 2017  
Programme: BE Full Marks: 100  
Course: Problem Solving Techniques Pass Marks: 45  
Time : 3hrs.

*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. | <ol style="list-style-type: none"> <li>Determine how many zeros end the number <math>1001!+305!</math>. <span style="float: right;">5</span></li> <li>What is the last digit of <math>7^{4563}</math>? <span style="float: right;">5</span></li> <li>Use mathematical induction to prove the following statements:<br/> <math>7^n - 1</math> is divisible by 6. <span style="float: right;">5</span></li> <li>If <math>a^2 + b^2 + c^2 + d^2 = ab + bc + cd + da</math> then show that<br/> <math>a = b = c = d</math> <span style="float: right;">5</span></li> </ol> |
| 2. | <ol style="list-style-type: none"> <li>Prove the law of sines: if <math>\Delta ABC</math> is a triangle, then<br/> <math display="block">\frac{\sin A}{\overline{BC}} = \frac{\sin B}{\overline{AC}} = \frac{\sin C}{\overline{AB}}</math> <span style="float: right;">8</span></li> <li>Find the number of vertex, edge and face if polyhedron with three pentagonal faces meets at each vertex. <span style="float: right;">7</span></li> </ol>  |
| 3. | <ol style="list-style-type: none"> <li>There are eighty marbles all looks the same but one is lighter find it in four weighing? <span style="float: right;">7</span></li> <li>Solve the given Crypto-arithmetic problem in which all different letters denote different integers. Identical letters denote the same integers. <span style="float: right;">8</span></li> </ol>  |

$$\text{ABCD} + \text{HEFG} = \text{EDAF}$$

OR

Examine the equations

$$1 = 1$$

$$1-4 = -(1+2)$$

$$1-4+9 = 1+2+3$$

$$1-4+9-16 = -(1+2+3+4)$$

Determine the pattern and prove the identity.

4. a) Demonstrate that if  $n$  is a positive integer exceeding 2 then 360 divides the number  $n^2(n^2 - 1)(n^2 - 4)$ . 5  
 b) Six people, named A, B, C, D, E, F, are in the dining car of a train. 5

They are one each from New York City, Chicago, Tulsa, San Francisco, Milwaukee, and Atlanta. The following facts are known:

- 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 the 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.

Match the names of the people with their professions and their cities.

5. a) A right angled triangle has sides of length l, m and 10. Note that 10 is not the hypotenuse, and that both l and m are integers. Find out the values of l and m such that with these three sides, right angled triangles can be formed. 5
- b) In a  $4 \times 4$  array of squares, put the first sixteen odd integers 1 to 31, one in each square, so that each row and each column adds up to same number. 5
- c) On Friday evening the weatherperson predicts 50% chance of rain on Saturday and 50% chance of rain on Sunday. What is the probability that it will rain at some time this weekend? 5
6. a) An efficiency expert is doing study of a certain fast food restaurant. She observes that a particular waiter drops 30% of all the hamburgers that he serves. What is the probability that he will drop exactly 4 out of 10? 5
- b) You have a piece of paper with a circle of radius between 2 inch and 4 inch drawn on it. You also have a plastic square of side 10 inches. You have no ruler and no compass. How can you find the center of the circle? 5
- c) On Friday evening the weatherperson predicts 50% chance of rain on Saturday and 50% chance of rain on Sunday. What is the probability that it will rain at some time this weekend? 5
7. Write short notes on: (Any two) 2x5
- a) Use of problem solving technique
  - b) Magic Square
  - c) Impossible problems

# POKHARA UNIVERSITY

Level: Bachelor  
Programme: BE  
Course: Problem Solving Techniques

Semester: Fall

Year : 2018  
Full Marks: 100  
Pass Marks: 45  
Time : 3hrs.

*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.  | 5 |
| b)    | A sheep can clear a certain field, eating the grass, in one day. A cow can clear the same field in half day. How long does it take the sheep and the cow, working together to clear the field?  | 5 |
| c)    | Assume that K is a positive integer. What is the sum of K natural numbers ?   | 5 |
| 2. a) | Assume that K is a positive integer. If (K+1) letters are delivered to K mailboxes, then show that one mailbox must contain at least two letters.   | 8 |
| b)    | Suppose we are given a triangle T with base AB. Give a constructive method for drawing a segment parallel to AB, terminating on the sides CA and CD of the triangle, that divides the triangle into two equal areas   | 7 |
| 3. a) | Assume that P is a regular polygon with K sides. What is the measure of any of the K angles formed by P ?   | 7 |
| b)    | Consider a polyhedron with three pentagonal faces meeting at each vertex. What can you conclude about the number of faces?  | 8 |
| 4. a) | Show that the following formula for the Fibonacci sequence is valid:  | 8 |
|       | $f_n = \frac{\left(\frac{1+\sqrt{5}}{2}\right)^n - \left(\frac{1-\sqrt{5}}{2}\right)^n}{\sqrt{5}}$  |   |
| b)    | Three people stand in a circle with their eyes closed. A hat is placed on each of their heads. Each hat is either red or black in color and all three players know this. They all open their eyes simultaneously and each player who sees a red hat is to raise a hand. The first player to them be able to correctly identify the color of his/her own hat will win a prize. With this setup, what will happen if two hats are red and one is black? | 7 |
| 5. a) | Six people named A,B,C,D,E,F are in a dining car of a train. They are   | 8 |

one each from New York City, Chicago, Tulsa, St. Louis, Milwaukee and Atlanta. The following facts are known.

1. A and the man from New York City are physicians.
2. E and the woman from Chicago are teachers.
3. The person from Tulsa and C are engineers.
4. B and F are veterans of Gulf war, but the person from Tulsa has never served in the military.
5. The person from Milwaukee is older than A.
6. The person from Atlanta is older than C
7. At St. Louis, B and the man from New York get off.
8. At San Francisco, C and the man from Milwaukee gets off.

Match the names of the people with their professions and their cities.

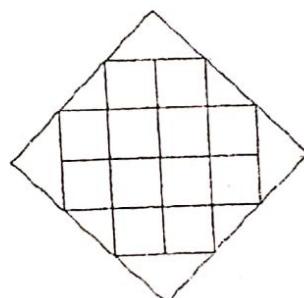
- b) Solve the crypto arithmetic problem that satisfy the following relation. Here each letter represents separate numbers between 0 to

9.

$$\begin{array}{r} \text{L E T S} \\ + \text{M O V E} \\ \hline \end{array}$$

L A T E R

6. a) Explain why the line drawing in figure cannot be traced with a single, continuous, non-overlapping stroke of the pen. 8



- b) A new car is equipped with three fuel saving devices. Device A by itself saves 40% on fuel; device B by itself saves 35% on fuel; and device C, by itself saves 25% on fuel. Now suppose that the three devices are used together and that they act independently. Will the combination save  $40+35+25=100\%$  on fuel? 7

7. Write short notes on: (Any two)
- a) Use of problem solving technique in real life
  - b) Use of Crypto-arithmetic problem
  - c) Proof by Contradiction

2×5

**POKHARA UNIVERSITY**

Level: Bachelor  
Programme: BE

Course: Problem Solving Technique

Semester: Spring

Year : 2018

Full Marks: 100

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) Assume that k is a positive integer. What is the sum of the integers

$$S = 1+2+3+\dots+(k-1)+k ?$$

- b) How many zeros end the number ?

$$6^{300} \times 15^{800}$$

$$\dots - 10^{99}$$

$$150!$$

2. a) There are k numbers of students in a class. At the beginning of each class hour, each student shakes hands with each of the other students. If k is even then will the number of handshakes that takes place be even or odd? If k is odd then will the number of handshakes that takes place be even or odd?

- b) Find the number of vertex, edge and face if five triangles faces meets at each vertex.

3. a) Assume that P is a regular polygon with k sides. What is the measure of any of the k angles formed by P?

- b) Express the area of the triangle with a formula using only the length of the triangles three sides.

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?

b) Prove:  $\cos(\alpha_2) \cdot \cos(\alpha_4) \cdot \cos(\alpha_8) = \frac{\sin(\alpha)}{8 \sin(\alpha_8)}$

5. a) A new car is equipped with three fuel saving devices. Device A, by

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itself, saves 25% on fuel; device B, by itself, saves 45% on fuel; and device C, by itself, saves 30 % on fuel. Now suppose that the three devices are used together and that they act independently. Will the combinations saves  $25 + 45 + 30 = 100\%$ ?

- b) Before noon, it started snowing at a constant rate (depth/hour). At noon a snow plough started to clear the snow at a constant rate (volume/hour). In the first hour snow-plough cleared two tractor of snow and in the second hour it cleared one tractor of snow, find the time when it started snowing. 7
6. a) In the town of Konigsberg, there are seven bridges as shown in figure. Draw a continuous path that crosses each bridges exactly once. If it is not possible, what may be the solution? 7
- b) Explain the process of creating magic square of 8X8 with example. 8
7. Write short notes on: (Any two) 2×5
- a) Use of problem solving technique in computer fields.
  - b) Problem of weighing.
  - c) Probability.

# POKHARA UNIVERSITY

Level: Bachelor

Programme: BE

Course: Problem Solving Techniques

Semester: Fall

Year : 2019

Full Marks: 100

Pass Marks: 45

Time : 3hrs.

*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 will the number of handshakes that takes place be even or odd? If 'k' is odd, then will the number of handshakes that takes place be even or odd? | 8 |
| b)    | i. Why $11^{10} - 1$ is divisible by 100?<br>ii. Find the last digit of $2^{34567}$   | 7 |
| 2. a) | A cube is inscribed by a right circular cone with radius 1 and height 3 units. Find the volume of the cube.   | 5 |
| b)    | Find the area of triangle by using the length of the sides of the triangle.   | 5 |
| c)    | Show that the angle subtended by semi-circle is right angle triangle.   | 5 |
| 3. a) | Separate a standard deck of 52 playing cards into five piles. What is the probability that one of the top card is a face card (King, Queen or Jack)?  | 7 |
| b)    | Examine the equations :   | 8 |

$$1 = 1$$

$$1 - 4 = -(1 + 2)$$

$$1 - 4 + 9 = 1 + 2 + 3$$

$$1 - 4 + 9 - 16 = -(1 + 2 + 3 + 4) \dots \dots \dots$$

Determine the pattern and prove the identity.

- |       |   |   |
|-------|---|---|
| 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. The player who removes the last chip wins. What strategy can the first player use so that he will always win? | 7 |
|-------|---|---|

- b) Show that the following formula for Fibonacci sequence is valid.

$$a_j = \frac{\left(\frac{1+\sqrt{5}}{2}\right)^{j+1} - \left(\frac{1-\sqrt{5}}{2}\right)^{j+1}}{\sqrt{5}}$$

7

5. 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.

8

- b) 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 women 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?

5

6. 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?

5

- b) Assume that  $K$  is a positive integer. If  $(K+1)$  letters are delivered to  $K$  mailboxes, then show that one mailbox must contain at least two letters.

5

- c) Prove the law of Sines: given a triangle  $\Delta ABC$  where  $A, B, C$  are vertices and  $a, b, c$  are the sides opposite to the angles.

7. Write short notes on: (Any two)

2×5

- a) Impossible problems with example  
b) Determine how many zeros end the number  $780! - 310!$   
c) Prove that there are infinitely many prime numbers

# POKHARA UNIVERSITY

Level: Bachelor

Programme: BE

Course: Problem Solving Techniques

Semester: Spring

Year : 2019

Full Marks: 100

Pass Marks: 45

Time : 3hrs.

*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) Assume that K is a positive integer. If (K+1) letters are delivered to K mailboxes, then show that one mailbox must contain at least two letters. 8
- 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) Imagine five planes in 3D space are kept in general position. Now find out into how many regions will these planes divide the space? 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
3. a) Show that the following formula for the Fibonacci sequence is valid: 7

$$a_j = \frac{\left(\frac{1+\sqrt{5}}{2}\right)^j - \left(\frac{1-\sqrt{5}}{2}\right)^j}{\sqrt{5}}$$

- b) Examine the equation :

$$1 = 1$$

$$1 - 4 = -(1 + 2)$$

$$1 - 4 + 9 = 1 + 2 + 3$$

$$1 - 4 + 9 - 16 = -(1 + 2 + 3 + 4)$$

Determine the pattern and prove this identity.

4. a) Solve the following Cryptoarithmatic problem. 8
- |        |  |
|--------|--|
| CROSS  |  |
| +ROADS |  |
| <hr/>  |  |
| 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:
- A and the man from New York is physicians.
  - E and the woman from Chicago are teachers.
  - The person from Tulsa and C are engineers.
  - B and F are veterans of the Gulf war, but the person from Tulsa has never served in the military.
  - The person from Milwaukee is older than A.
  - The person from Atlanta is older than C.
  - At St. Louis, B and the man from New York get off.
  - At San Francisco, C and the man from Milwaukee get off.

Match the names of the people with their professions and their cities.

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 four people cross the river? What is the fewest numbers of trips possible?
- b) A 10 years old child puts \$100 in the bank. She intended to withdraw the money on her 21<sup>st</sup> birthday. Which one scheme is better for her:
- an account with 5% interest compounded daily **OR**
  - an account with 5.1% interest compounded weekly ?

6. a) Suppose that you have 12 pearls, all appearing the same but with one having an odd weight. You do not know whether the odd pearl is heavier or lighter. How many weighing are needed to find the odd pearls.

- b) i. Why  $11^{10} - 1$  is divisible by 100?  
ii. Find the last digit of  $2^{34567}$ ?

7. Write short notes on: (**Any two**)

- Solving strategy of magic square
- Determine how many zeros end the number  $780! - 310!$ .
- Usefulness of PST in programming.

7

8

7

8

$2 \times 5$

# POKHARA UNIVERSITY

Level: Bachelor

Programme: BE

Course: Problem Solving Techniques

Semester: Fall

Year : 2020

Full Marks: 100

Pass Marks: 45

Time : 3hrs.

*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) A certain number K is a multiple of 9. Add those digits together. If the result has more than one digit, add those together again. Continue those adding digits together until you have a one digit answer. It will be a 9. Explain why this is so? 8
  - b) Find all pairs of integers m,n such that  $m \cdot n = m+n$ . Explain with example. 7
  2. a) 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? 8
  - b) Assume that n is a positive integer. How many triangles with integral side length, are there such that the longest side has length n? 7
  3. a) What are the last two digits of  $3^{27}$ ? Use binomial formula to find it. 7
  - b) Solve the given Crypto-arithmetic problem in which all different letters denote different integers. Identical letters denote the same integers. 8
- ABCD + PQR = AQCB**
4. a) Examine the equations 8

$$1 = 1$$

$$1 - 4 = -(1+2)$$

$$1 - 4 + 9 = 1 + 2 + 3$$

$$1 - 4 + 9 - 16 = -(1 + 2 + 3 + 4)$$

Determine the pattern and prove the identity. 7

- 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 first player use so that he will always win?

7

5. a) How many 7's are used in writing out all the positive integers from 1 to  $10^7$ ? Explain it..

8

- 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:

- i. A and the man from New York is 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 the 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.

Match the names of the people with their professions and their cities.

8

6. a) i. Why  $11^{10} - 1$  is divisible by 100?  
ii. Find the last digit of  $2^{34567}$ ?

7

- b) Suppose that you have another addition of encyclopedia with six volumes. The covers are 0.20" thick, but the paper portion in each volume is 0.6" thick. Then how far does the worm have to crawl to get from the very first page of volume 1 to the very last page of volume 4? and how far does the worm have to crawl to get from the very last cover page of volume 2 to the very first page of volume 6?

2×5

7. Write short notes on: (Any two)

- a) Use of geometry in computer.
- b) Determine how many zeros end the number  $780! - 310!$ .
- c) Voting methods used in real life

**POKHARA UNIVERSITY**

Level: Bachelor

Semester - Spring

Year: 2020

Program: BE

Full Marks: 70

Course: Problem Solving Techniques

Pass Marks: 31.5

Time: 2 hrs

*Candidates are required to answer in their own words as far as practicable.*

*The figures in the margin indicate full marks.*

**Attempt all the questions.**

**Section - A: (5×10=50)**

Q. N. 1 Find the sum of first K square numbers.

10

**OR**

Each morning I purchase an item for 99 cents and in the afternoon I sell it for one dollar. I do this each day for one year. Do an analysis showing that I'm making 1% profit on total sales. Now do an analysis showing that I'm making 365% on money invested.

Q. N. 2 Draw a planar grid that is 31 squares wide and 17 square high. How many different non-trivial rectangles can be drawn, using the lines of the grid to determine the boundaries?

10

Q. N. 3 A game is played by two players. They begin with a pile of 40 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 first player use so that he will always win? Solve the crypto arithmetic problem  $(A T O M)^{1/2} = A + T O + M$ .

6+4

Q. N. 4 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 lighter or heavier, you do not know which. The only equipment that you have at your hand is a balance scale. How can you use the scale to find the odd pearl in just three weighing? Construct a  $3 \times 3$  magic square of first 9 odd integers so that sum of each row or each column is equal to 27.

6+4

Q. N. 5 Show that  $|\cos x - \sin x| \leq \sqrt{2}$ , with equality only if  $\sin 2x = -1$ . Solve the equation:  

$$8(4^x + 4^{-x}) - 54(2^x + 2^{-x}) + 101 = 0$$

5+5

**Section - B: (1×20=20)**

Q. N. 6 Express the area of a triangle with a formula using only the length of the triangles of the triangle's three sides. Use that formula to find the area of a triangles with sides  $n$ ,  $(n+1)$  and  $(n+2)$ , and with area  $(A)=6$ .

20

# POKHARA UNIVERSITY

Level: Bachelor

Semester: Fall

Year : 2021

Programme: BE

Full Marks: 100

Course: Problem Solving Techniques

Pass Marks: 45

Time : 3hrs.

*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) Assume that K is a positive integer. If  $(K+1)$  letters are delivered to K mailboxes, then show that one mailbox must contain at least two letters. 8
- b) i. Why  $11^{10} - 1$  is divisible by 100? 7  
    ii. Find the last digit of  $2^{34567}$ ? 7
- 2. a) Find the sum of square of first K positive integer. 8
- b) Find the number of vertex, edge and face if three pentagon faces meets at each vertex. 7
- 3. a) Imagine a steel band strapped tightly around the equator of the earth. Such a band would be about 25,000 miles long. Now suppose that we lengthen the band just enough so that it stands uniformly one foot off the surface of the earth (but still forms a continuous circular loop). How long will it be now? 8
- b) Consider a unit cube with four of its eight vertices joined to form a regular tetrahedron with vertices A, B, C, D. What is the ratio of the surface area of the cube to the surface area of the tetrahedron? 7
- 4. a) Prove that: 7
 
$$2 < \frac{1}{\log_2 \pi} + \frac{1}{\log_5 \pi}.$$
- b) Solve the Crypto arithmetic problem for: 8
 

T R U E
+ T R U E
-----
F A L S E

5. a) i. Prove that there are infinitely many primes. 8  
ii. Show that the angle subtended by semi circle is right angle triangle.
- b) Examine the equations 7
- $1 = 1$
- $3 + 5 = 8$
- $7 + 9 + 11 = 27$
- $13 + 15 + 17 + 19 = 64$
- $21 + 23 + \dots + 29 = 125.$
- Determine the pattern and prove the identity.
6. a) A heard of cows invades a dance causing damage in the field. The 8  
boys were chasing them. There are 130 heads & 300 feet but 5 cows  
have 3 legs & 2 men have 1 leg. Find the number of cows and boys.
- b) A new car is equipped with three fuel saving devices. Device A by 7  
itself saves 40% on fuel; device B by itself saves 35% on fuel; and  
device C, itself saves 25% on fuel. Now suppose that the three  
devices are used together and that they act independently. Will the  
combination save  $40+35+25=100\%$  on fuel?
7. Write short notes on: (Any two)  $2 \times 5$
- a) Use mathematical induction to prove the statement:  $7^n - 1$  is divisible  
by 6.
- b) Is  $10^{1/10} > 2^{1/3}$  ?
- c) Proof by contradiction

# POKHARA UNIVERSITY

Level: Bachelor  
Programme: BE  
Course: Problem Solving Technique

Semester: Spring

Year : 2021  
Full Marks: 100  
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) A teacher asked to find sum of first 30 odd numbers. Student gave answer 900 in 20 second time. Again teacher asked to find sum of first 80 odd numbers the student gave answer in 20 second time? So, derive the logic behind it, and find solution of sum of 80 odd numbers. 8
  - b) How many zeros end the number ? 7
- $$\begin{array}{r}
 6^{300} \times 15^{800} \\
 \hline
 & - 10^{99} \\
 & 150!
 \end{array}$$
2. a) i. Why  $11^{10} - 1$  is divisible by 100? 4+4  
ii. Find the last digit of  $2^{34567}$ ?
  - b) Express the area of the triangle with a formula using only the length of the triangles three sides. 7
  3. a) A cube of side r is inscribed in a sphere. The sphere is inscribed in a cone with side length equal the diameter of its base. The cone is inscribed in a right circular cylinder. What is the surface area of the cylinder (including top and bottom)? 7  
b) Find the number of vertex, edge and face if five triangles faces meets at each vertex. 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. The player who removes the last chip wins. What strategy can the first player use so that he will always win? 8  
b) Explain the process of creating magic square of  $5 \times 5$  with example. 7
  5. a) Before noon, it started snowing at a constant rate (depth/hour). At noon a snow plough started to clear the snow at a constant rate 7

(volume/hour). In the first hour snow-plough cleared two tractor of snow and in the second hour it cleared one tractor of snow, find the time when it started snowing.

- b) Show that the following formula for Fibonacci sequence is valid. 8

$$a_j = \frac{\left(\frac{1+\sqrt{5}}{2}\right)^{j+1} - \left(\frac{1-\sqrt{5}}{2}\right)^{j+1}}{\sqrt{5}}$$

6. 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 four people cross the river? What is the fewest numbers of trips possible? 7
- b) A 10 years old child puts Rs. 100000 in the bank. She intended with withdraw the money on her 21<sup>st</sup> birthday. Which one scheme is better for her? 8
- An account with 5% interest compounded daily
  - An account with 5.1% interest compounded weekly
7. Write short notes on: (Any two) 2×5
- Use mathematical induction to prove the statement:  $7^n - 1$  is divisible by 6
  - 8, 16, 64, 128, 512, \_\_\_\_\_?
  - Problem of weighing.