



INDIAN INSTITUTE OF TECHNOLOGY TIRUPATI
DEPARTMENT OF MATHEMATICS AND STATISTICS

MA5191-Programming Laboratory
Python Assignment

Answer All Questions Questions [20]

Write a Python program for the following

1. Convert a given integer (in seconds) to hours, minutes and seconds. [2]
2. Accept employee's ID (char ID[10]), number of hours worked in a month (int), salary per hour (float) and then calculate and print the employee's monthly salary. [1]
3. Calculate the body mass index (BMI) [1]

$$BMI = \frac{Weight[Kg]}{Height[m] \times Height[m]}$$

4. Calculate the total surface area and volume of the following solids [8 × 2 = 16]
 - (a) Right circular Cylinder (input: height, radius)
 - (b) Sphere (input: radius)
 - (c) Right circular Cone (input: radius, height, slant height)
 - (d) Hemisphere (input: radius)
 - (e) Cuboid (input: three sides)
 - (f) Prism (input: base area, lateral area, height. surface area=2*base area+lateral area, volume=base area*height)
 - (g) Pyramid (input: base area, lateral area, height. surface area=base area+lateral area, volume =(1/3)base area*height)
 - (h) Regular polyhedron (input: face area, number of side, output: only surface area, surface area=face area*number of sides)

Branching: Answer Any Four Questions [$4 \times 5 = 20$]

Write a Python program for the following

1. Check given input is integer, if so, check whether it is positive, negative or zero
2. Get a week number(1-7) and print day of week name.
3. Get the roll number, name, 5 subject marks(Maths, Physics, Chemistry, Computer Science, Language) of a student. Each subject marks should be in the range $[0, 200]$. If it is not in the range, instruct the user that invalid input. Calculate the percentage. Also, calculate and announce the grades based on the percentage. $\text{percentage} \geq 90$: S grade, $80 \leq \text{percentage} < 90$: A grade, $70 \leq \text{percentage} < 80$: B grade, $60 \leq \text{percentage} < 70$: C Grade, $50 \leq \text{percentage} < 60$: D Grade, $40 \leq \text{percentage} < 50$: E Grade, $0 \leq \text{percentage} < 40$: U Grade.
4. Get an integer, check whether it is positive or negative. If it is positive and less than 100, calculate the sum of the digits of this integer. If it is negative, say error in your input.
5. Compute the roots of the quadratic equation $ax^2 + bx + c = 0$. Accept the values of a, b, c as input. Calculate the roots and print out the roots and their nature, real or imaginary, real and equal, real and distinct based on its discriminant.
6. Get three sides of a triangle and check whether it is valid triangle. If it is a valid triangle, check whether it is equilateral, scalene or isosceles triangle.
7. Check whether given integer is odd or even.

Looping: Answer All Questions [$3 \times 10 = 30$]

Write a Python program for the following

1. Check whether given input integer is one of the following. (Get input from user which one does he/she like to check. Use if ... else)
 - (a) Palindrome
 - (b) Perfect
 - (c) Armstrong
 - (d) Prime
 - (e) Triangular
 - (f) Pentagonal
 - (g) Hexagonal

2. Calculate the sum of Taylor series of the following functions. Get x and n as input. (Get input from user which one does he/she like to check. Use if ... else). Use math functions from import math library such as $\exp(x)$, $\sin(x)$ and $\cos(x)$ to check the accuracy of your calculations.

(a) e^x

(b) $\sin(x)$

(c) $\cos(x)$

3. Let A, B and C be respectively the set of all triangular, pentagonal and hexagonal numbers between 1 and 10^5 . Generate 1000 integers randomly between 1 and 10^5 (say the universal set X). Select an integer $x_n \in X$. Use your probability theory knowledge, to compute $P(x_n)$ if $x_n \in A$ or B or C or $A \cap B$ or $A \cap B \cap C$ or $A \cap C$ or $B \cap C$ and so on. Compute

$$\sum_{n=1}^{1000} P(x_n)$$

Hint:

$$P(x_n) = \begin{cases} \frac{1}{|A|} & \text{if } x_n \in A \\ \frac{1}{|B|} & \text{if } x_n \in B \\ \frac{1}{|C|} & \text{if } x_n \in C \end{cases}$$

Challenges from Project Euler: Answer any one [30]

1. Power Digit Sum: Write a Python program to get an exponent of x . Now,

$$2^x = a_0 a_1 a_2 \cdots a_n, \quad a_i \in \{0, 1, 2, \dots, 9\}, x \in \mathbb{N}$$

Compute

$$f(x) = \sum_{i=0}^n a_i$$

For example, $2^{15} = 32768$ and the sum of its digits is

$$f(15) = \sum_{i=0}^n = 3 + 2 + 7 + 6 + 8 = 26$$

Compute $f(1000)$.

2. Let $d(n)$ be defined as the sum of proper divisors of n (numbers less than n which divide evenly into n). If $d(a) = b$ and $d(b) = a$, where $a \neq b$, then a and b are an amicable pair and each of a and b are called amicable numbers.

For example, the proper divisors of 220 are 1, 2, 4, 5, 10, 11, 20, 22, 44, 55 and 110; therefore $d(220) = 284$. The proper divisors of 284 are 1, 2, 4, 71 and 142; so $d(284) = 220$.

Evaluate the sum of all the amicable numbers under 10000.