THE UNIVERSITY OF HONG KONG

MSc in Computer Science Admission Test

Date: December 7, 2020
Test time: 2:00pm – 2:50pm
Submission deadline: WITHIN 15 minutes after the end of test
[Please submit your answer file (a single PDF file) to the webpage:
by 3:05pm, December 7, 2020.]

Name:	**Application No.**

Q1. A square table of positive integers is called a **magic square** if the sums of the numbers in each row, each column, and both main diagonals are the same. For example, the table

2	7	6
9	5	1
4	3	8

is a magic square. Write a program that reads a positive integer n, and then reads n^2 poistive integers for a n x n table (the first n positive integers are the numbers at the first row, the next n numbers are those at the 2nd row, and so on), and then prints "yes" if the table is a magic square, and prints "no" otherwise. For example, if the input is

3 2 7 6 9 5 1 4 3 8

then your program should print "yes".

Q2. There are 10 stacks of 32 coins (totally we have 320 coins), and there is exactly one stack in which all its coins are fake (i.e., counterfeit), and all the coins in the remaining 9 stacks are genuine. Every genuine coin weighs 10 grams, and every fake coin weighs 11 grams. You have a scale that can tell you the total weight of any selection of coins. Design a method that uses the scale to find the stack of fake coins. (An obvious solution uses the scale ten times. You should try to use the scale as few times as possible.)

Q3:

(a) Compute $\frac{d}{dx}\left(\frac{1}{\sqrt{1-x^2}}\right)$.

(b) Compute $\int_0^1 (e^x x)\, dx$.

Q4.

(i) How many bit strings of length eight either start with a 1 bit or end with two bits 00?

(ii) In the computer language BASIC, the name of a variable is a string of one or two alphanumeric characters, where uppercase and lower case letters are not distinguished. (An alphanumeric character is either one of the 26 English letters or one of the 10 digits.) Moreover, a variable name must begin with a letter and must be different from the five strings of two characters that are reserved for programming use. How many different variable names are there in BASIC.

Q5 Giving that the initial capital is $10,000, annual interest rate is 4%, answer the following questions. You can put down the formula.

(a) Using simple interest, what will be the total amount after 10 years?

(b) Using compound interest, what will be the total amount after 10 years?

(c) Using compound interest calculated monthly, what will be the total amount after 10 years?