# Homework 3 Validation and verification

1. Customers at a supermarket enter a monthly raffle to win a prize, which is the chance to receive the contents of their shopping cart free. To enter the raffle a customer must enter a number of random digits into a machine at the checkout, and the number is printed on their receipt.

The machine checks that the entry is valid using the pseudocode shown below. The operator **div** performs integer division, so that for example 24 div 7 returns 3.

INPUT n

d 🡨0

repeat

n 🡨 n div 10

d 🡨 d + 1

UNTIL n = 0

IF d <> 6 THEN

OUTPUT “Invalid entry”

ELSE

OUTPUT “Entry accepted”

(a) Put a tick in the correct column to show which message is displayed for each of the following entries. Use the trace tables with columns headed **n** and **d**. [8]

|  |  |  |
| --- | --- | --- |
| **number** | **“Entry accepted”** | **“Invalid entry”** |
| 103050 |  |  |
| 46729 |  |  |
| 001854 |  |  |
| 100000 |  |  |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Trace table** | |  | **Trace table** | |  | **Trace table** | |  | **Trace table** | |
| **n** | **d** |  | **n** | **d** |  | **n** | **d** |  | **n** | **d** |
| 103050 | 0 |  | 46729 | 0 |  | 001854 | 0 |  | 100000 | 0 |
|  |  |  |  |  |  |  |  |  |  |  |
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(b) Formulate a rule for a valid raffle ticket number. [2]

2. A check digit for a five-digit product number is calculated as follows:

* assign weights of 6, 5, 4, 3, 2 to each of the digits of the number, starting from the most significant (leftmost) digit
* multiply each digit by its weight
* add the resulting numbers together
* divide by 10 using integer division
* Subtract the remainder from 10
* If the remainder is zero, the check digit is zero
* Otherwise, subtract the remainder from 10 and the result is the check digit

(a) Calculate the check digit for the number 25461. [1]

(b) The following pseudocode is designed to calculate the check digit of a 5-digit code as described in part (a) above.

The operator **mod** finds the remainder when a is divided by b

productCode 🡨 []

weight 🡨 6

weightedSum 🡨 0

OUTPUT (“Enter 5-digit product code without check digit”)

INPUT productCode

FOR number = 1 to 5

weightedDigit 🡨 int(productCode[number]) \* weight

weightedSum 🡨 weightedSum + weightedDigit

weight 🡨 weight – 1

NEXT number

remainder 🡨 weightedSum mod 10

checkDigit 🡨 10 – remainder

productCode[6] 🡨 checkDigit

There is a logic error in the program.

(i) Complete the trace table below to find the value of the check digit and product code if the user enters the code 12345. [6]

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **productCode** | | | | | |  |  |  |  |  |  |
| **1** | **2** | **3** | **4** | **5** | **6** | **number** | **weighted**  **Digit** | **weighted**  **Sum** | **weight** | **remainder** | **check**  **Digit** |
| 1 | 2 | 3 | 4 | 5 |  |  |  | 0 | 6 |  |  |
|  |  |  |  |  |  | 1 | 6 | 6 | 5 |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
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|  |  |  |  |  |  |  |  |  |  |  |  |

(ii) Add one or more statements to correct the logic error. Where should the statement(s) be inserted? Indicate with an arrow on the pseudocode. [3]

[Total 20 marks]