بسم الله الرحمن الرحيم

DEPARTMENT OF CIVIL ENGINEERING – KFUPM

Numerical and Statistical Methods in Civil Engineering

CE 318- 51-'11 (111)

Lab. Sessions NO. 1 & 2

Subj.: **Computer Arithmetic; Machine Errors and Loss of Precision.**

DATE: Sep. 19,'11

Objective:

The **main objective** is to emphasize the importance of key issues that are pre-requisite for *efficiency*, *accuracy* and *precision* when a numerical-code is designed to execute numerical calculations. The issues include: a) use of a flow-chart; b) use of DO-loops; c) use of logical arguments for decisions; d) subscripted variables; e) use of INPUT/OUTPUT computer parameters; and f) planning to avoid loss of computational accuracy.

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1. Construct an EXCEL-sheet to compare the *analytical* and *numerical* solution for the Parachutist's problem (presented and analyzed in first lab-session) to determine the falling speed at any moment of time.

2. Write a computer code [e.g.: FORTRAN code] to Compute the smallest positive number ***meps*** that can be represented on a computing-machine such

   $Q = 1.0 + meps$ is always greater than 1.0 …… [1]

Note-1: When *Q* is included within a DO-loop, the **machine epsilon *meps,*** *is obtained from the first value that violates equation* [1] *above.*

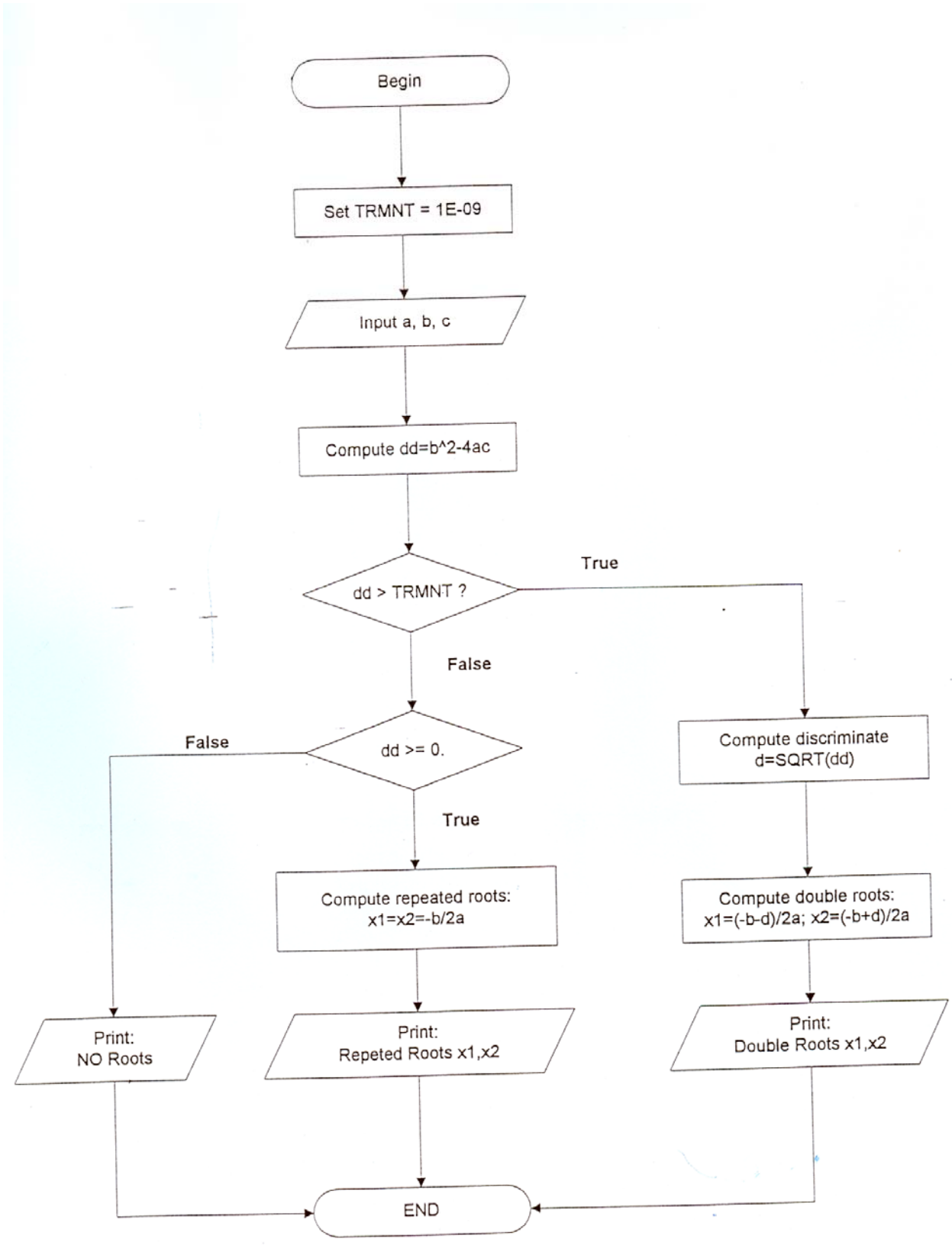
3. Write a computer code to compute sum ***Q*** of adding to 1.0 a very small positive number ***SPN*** (e.g. 1×10^{-6}) N times. Use a DO-loop and use *single* and *double* precision to compare your results when N= 1000.

Note-2: The values of *Q* and *SPN* must be declared in single or double precision.

Procedure for Evaluation:

i) Start working in the assigned session, then complete your computer works within the session or afterwards using the same computing machine on which you may save your work for future use (if necessary).

ii) Submit for evaluation your summary of organized computer work assignment in the beginning of the next lab.



Typical *Flowchart* for computing the roots of a quadratic equation