

CHAPTER VI

PROGRAM RUNNING

The following section describe the development of the program, the features of the program and its limitations and the procedure to run the program. Additionally, the detail flowchart and the listing of the source program are presented in Appendix A and B respectively.

6.1 Features and Limitation of Program

The present program was developed from an earlier version published in Process Modelling Simulation and Control for Chemical engineer (1981). The program was coded in FROTRAN IV to utilize its powerful formatting features highly suitable to complex scitific, mathematical, engineering algorithms and it is executed on a personal computer. The flowchart notation used in Appendix A corresponded to specific program statements in Appendix B. The flowchart illustrated the algorithm used and the rediments of programming in the 1977 version of the FORTRAN IV language.

The requirements needed to run the program are:

Hardware : A personal computer with two disk drives and 640 K of random-access memory operating on the Disk Operating System (DOS command).

Software : A 3.5-inch double-sided, high-density, soft section disketed containing the source and working program.

6.1.1 Program Features

The source program was coded and edited using Program's Workbench software as line editor and identified by the filename of DYSIM.FOR (see Appendix B). The working program was compiled and ready to execute version obtained with MICROSOFT FORTRAN Programming Software (Version 5.1). Its filename and extension were DYSIM.EXE.

6.1.2 Program Limitations

- Maximum numbers of ten components and fifty stages are allowed.
- Pressure is assumed constant on each stage but varies linearly up the column from P_B in the base to P_D at the top.
- There is one feed plate onto which vapour feed and liquid feed is introduced.

6.2 Procedure to run the program

Step 1 : Start-up Procedure

Switches on the personal computer and boot the system with DOS commands. Load the working program from file DYSIM.EXE.

Step 2 : Input stream data

The program will prompt the user to input all necessary data by selection number from main menu on the display screen. Caution: The name of component must be typed in CAPITAL LETTER.

Step 3 : Output of Results

The results of simulation will be written into a data file namely RESULT.DAT and will be displayed consecutively table of compositions for each stage in various time. In case a hard copy (printout) is desired, use the editor programming to open the data file and print it by editor's printing command.

The instructions that follow is an example to illustrate how the program was run and what the output were obtained after a run. To distinguish the program statements from the user's responses, user-typed characters are underlined throughout these examples.

Program Execution :

Step 1 : Start-up procedure

Load the working program by typing the working file name.

A> DYSIM

Step 2 : Input data

Select the number from main menu to input data step by step. Input data to displayed questions. See underlined characters.

**** MAIN MENU ****

- 0) Exit to Dos
- 1) Components Database
- 2) Characteristic of Column
- 3) Operating Conditions
- 4) Feed Data
- 5) Initial Conditions
- 6) Edit Input Data
- 7) Save Input data
- 8) Run
- 9) Reporting & Reviewing the results

Please ENTER your selection : 1

*** Component Selection ***

The name must be typed in CAPITAL LETTER

Total number of component (NC) = 6

Component Name no. 1 = PROPANE

Component Name no. 2 = ISOBUTANE

Component Name no. 3 = N-BUTANE

Component Name no. 4 = ISOPENTANE

Component Name no. 5 = N-PENTANE

Component Name no. 6 = N-HEXANE

Press ENTER to continue

**** MAIN MENU ****

- 0) Exit to Dos
- 1) Components Database
- 2) Characteristic of Column
- 3) Operating Conditions
- 4) Feed Data
- 5) Initial Conditions
- 6) Edit Input Data
- 7) Save Input data
- 8) Run
- 9) Reporting & Reviewing the results

Please ENTER your selection : 2

**** Characteristic of Column ****

Total number of plates (NT) = 25
Number of trays in stripping section (NF) = 9
Weir height in stripping section (WHS) = 3.44
Weir height in rectifying section (WHR) = 3.44
Column diameter in stripping section (DS) = 72.0
Column diameter in rectifying section (DR) = 72.0
Weir length in stripping section (WLS) = 51.1
Weir length in rectifying section (WLR) = 51.1
Volumetric holdup in column base (MVB) = 130.0
Volumetric holdup in reflux drum (MVD) = 98.0

Do you need to input a Characteristic of compartment? (Y/N) : N

Press ENTER to continue

**** MAIN MENU ****

- 0) Exit to Dos
- 1) Components Database
- 2) Characteristic of Column
- 3) Operating Conditions
- 4) Feed Data
- 5) Initial Conditions
- 6) Edit Input Data
- 7) Save Input data
- 8) Run
- 9) Reporting & Reviewing the results

Please ENTER your selection : 3

**** Operating Conditions ****



Pressure in top of column PD, (psia) = 126.57
Pressure in bottom of column PB, (psia) = 133.04
Reboiler heat-duty QR, (x 1,000 Btu/hr) = 4980.0
Reflux rate R, (moles/hr) = 1000.0
Vapor product from reflux drum DV, (moles/hr) = 0.0
Murphree vapor-phase tray efficiency EFF = 0.9

Press ENTER to continue

**** MAIN MENU ****

- 0) Exit to Dos
- 1) Components Database
- 2) Characteristic of Column
- 3) Operating Conditions
- 4) Feed Data
- 5) Initial Conditions
- 6) Edit Input Data
- 7) Save Input data
- 8) Run
- 9) Reporting & Reviewing the results

Please ENTER your selection : 4

**** Feed Data ****

Liquid Feed flow rate (moles/hr) = 1263.11

Liquid Feed temperature (F) = 233.60

Composition (mole fraction) :

PROPANE = 0.038730

ISOBUTANE = 0.037720

N-BUTANE = 0.16720

ISOPENTANE = 0.20764

N-PENTANE = 0.22923

N-HEXANE = 0.31947

**** Feed Data ****

Vapor Feed flow rate (moles/hr) = 1.9

Vapor Feed temperature (F) = 233.60

Composition (mole fraction) :

PROPANE = 0.135310

ISOBUTANE = 0.075961

N-BUTANE = 0.277460

ISOPENTANE = 0.194620

N-PENTANE = 0.187760

N-HEXANE = 0.128890

Press ENTER to continue

**** MAIN MENU ****

- 0) Exit to Dos
- 1) Components Database
- 2) Characteristic of Column
- 3) Operating Conditions
- 4) Feed Data
- 5) Initial Conditions
- 6) Edit Input Data
- 7) Save Input data
- 8) Run
- 9) Reporting & Reviewing the results

Please ENTER your selection : 5

**** Initial Conditions ****

Temperature in column base TB, (F) = 290.66

Composition in column base :

PROPANE = 0.30702E-5

ISOBUTANE = 0.24437E-3

N-BUTANE = 0.47600E-2

ISOPENTANE = 0.13585

N-PENTANE = 0.22011

N-HEXANE = 0.63904

**** Initial Conditions ****

Temperature in tray no. 1 (F) = 277.52

Liquid flow rate in tray no. 1 (moles/hr) = 2364.0

Composition in tray no. 1 :

PROPANE = 0.11084E-4

ISOBUTANE = 0.58146E-3

N-BUTANE = 0.98300E-2

ISOPENTANE = 0.19153

N-PENTANE = 0.28323

N-HEXANE = 0.51482

**** Initial Conditions ****

Temperature in tray no. 2 (F) = 268.88

Liquid flow rate in tray no. 2 (moles/hr) = 2387.7

Composition in tray no. 2 :

PROPANE = 0.35139E-4

ISOBUTANE = 0.11800E-2

N-BUTANE = 0.17270E-1

ISOPENTANE = 0.23231

N-PENTANE = 0.31737

N-HEXANE = 0.43184



**** Initial Conditions ****

Temperature in tray no. 3 (F) = 263.12

Liquid flow rate in tray no. 3 (moles/hr) = 2403.5

Composition in tray no. 3 :

PROPANE = 0.10474E-3

ISOBUTANE = 0.22100E-2

N-BUTANE = 0.27630E-1

ISOPENTANE = 0.25764

N-PENTANE = 0.32858

N-HEXANE = 0.38387

**** Initial Conditions ****

Temperature in tray no. 4 (F) = 258.80

Liquid flow rate in tray no. 4 (moles/hr) = 2407.02

Composition in tray no. 4 :

PROPANE = 0.30147E-3

ISOBUTANE = 0.39100E-2

N-BUTANE = 0.41700E-1

ISOPENTANE = 0.27040

N-PENTANE = 0.32563

N-HEXANE = 0.35806

**** Initial Conditions ****

Temperature in tray no. 5 (F) = 254.66

Liquid flow rate in tray no. 5 (moles/hr) = 2400.12

Composition in tray no. 5 :

PROPANE = 0.84631E-3

ISOBUTANE = 0.66600E-2

N-BUTANE = 0.60310E-1

ISOPENTANE = 0.27347

N-PENTANE = 0.31461

N-HEXANE = 0.34411

**** Initial Conditions ****

Temperature in tray no. 6 (F) = 249.98

Liquid flow rate in tray no. 6 (moles/hr) = 2383.72

Composition in tray no. 6 :

PROPANE = 0.23200E-2

ISOBUTANE = 0.11000E-1

N-BUTANE = 0.83960E-1

ISOPENTANE = 0.26832

N-PENTANE = 0.29861

N-HEXANE = 0.33578

**** Initial Conditions ****

Temperature in tray no. 7 (F) = 244.04

Liquid flow rate in tray no. 7 (moles/hr) = 2357.61

Composition in tray no. 7 :

PROPANE = 0.61900E-2

ISOBUTANE = 0.17510E-1

N-BUTANE = 0.11214

ISOPENTANE = 0.25552

N-PENTANE = 0.27885

N-HEXANE = 0.32978

**** Initial Conditions ****

Temperature in tray no. 8 (F) = 235.58

Liquid flow rate in tray no. 8 (moles/hr) = 2318.68

Composition in tray no. 8 :

PROPANE = 0.15910E-1

ISOBUTANE = 0.26590E-1

N-BUTANE = 0.14209

ISOPENTANE = 0.23520

N-PENTANE = 0.25568

N-HEXANE = 0.32452

**** Initial Conditions ****

Temperature in tray no. 9 (F) = 223.52

Liquid flow rate in tray no. 9 (moles/hr) = 2261.31

Composition in tray no. 9 :

PROPANE = 0.38730E-1

ISOBUTANE = 0.37720E-1

N-BUTANE = 0.16720

ISOPENTANE = 0.20764

N-PENTANE = 0.22923

N-HEXANE = 0.31947

**** Initial Conditions ****

Temperature in tray no. 10 (F) = 211.28

Liquid flow rate in tray no. 10 (moles/hr) = 918.85

Composition in tray no. 10 :

PROPANE = 0.41350E-1

ISOBUTANE = 0.41970E-1

N-BUTANE = 0.19099

ISOPENTANE = 0.28603

N-PENTANE = 0.27468

N-HEXANE = 0.16498

**** Initial Conditions ****

Temperature in tray no. 11 (F) = 204.08

Liquid flow rate in tray no. 11 (moles/hr) = 976.06

Composition in tray no. 11 :

PROPANE = 0.43060E-1

ISOBUTANE = 0.44880E-1

N-BUTANE = 0.20845

ISOPENTANE = 0.34472

N-PENTANE = 0.28590

N-HEXANE = 0.72990E-1

**** Initial Conditions ****

Temperature in tray no. 12 (F) = 200.12

Liquid flow rate in tray no. 12 (moles/hr) = 1011.21

Composition in tray no. 12 :

PROPANE = 0.44110E-1

ISOBUTANE = 0.46840E-1

N-BUTANE = 0.22198

ISOPENTANE = 0.38375

N-PENTANE = 0.27382

N-HEXANE = 0.29500E-1

**** Initial Conditions ****

Temperature in tray no. 13 (F) = 197.42
Liquid flow rate in tray no. 13 (moles/hr) = 1029.37

Composition in tray no. 13 :

PROPANE = 0.44890E-1
ISOBUTANE = 0.48520E-1
N-BUTANE = 0.23563
ISOPENTANE = 0.40906
N-PENTANE = 0.25055
N-HEXANE = 0.11340E-1

**** Initial Conditions ****

Temperature in tray no. 14 (F) = 195.08
Liquid flow rate in tray no. 14 (moles/hr) = 1038.91

Composition in tray no. 14 :

PROPANE = 0.45670E-1
ISOBUTANE = 0.50440E-1
N-BUTANE = 0.25291
ISOPENTANE = 0.42411
N-PENTANE = 0.22265
N-HEXANE = 0.42200E-2

**** Initial Conditions ****

Temperature in tray no. 15 (F) = 192.56
Liquid flow rate in tray no. 15 (moles/hr) = 1045.16
Composition in tray no. 15 :
PROPANE = 0.46620E-1
ISOBUTANE = 0.52980E-1
N-BUTANE = 0.27698
ISOPENTANE = 0.42909
N-PENTANE = 0.19280
N-HEXANE = 0.15200E-2

**** Initial Conditions ****

Temperature in tray no. 16 (F) = 189.32
Liquid flow rate in tray no. 16 (moles/hr) = 1051.09
Composition in tray no. 16 :
PROPANE = 0.47870E-1
ISOBUTANE = 0.56520E-1
N-BUTANE = 0.31088
ISOPENTANE = 0.42210
N-PENTANE = 0.16209
N-HEXANE = 0.53214E-3

**** Initial Conditions ****

Temperature in tray no. 17 (F) = 185.18
Liquid flow rate in tray no. 17 (moles/hr) = 1058.58
Composition in tray no. 17 :
PROPANE = 0.49490E-1
ISOBUTANE = 0.61440E-1
N-BUTANE = 0.35719
ISOPENTANE = 0.40050
N-PENTANE = 0.13121
N-HEXANE = 0.17765E-3

**** Initial Conditions ****

Temperature in tray no. 18 (F) = 180.14
Liquid flow rate in tray no. 18 (moles/hr) = 1069.19
Composition in tray no. 18 :
PROPANE = 0.51510E-1
ISOBUTANE = 0.68040E-1
N-BUTANE = 0.41671
ISOPENTANE = 0.36255
N-PENTANE = 0.10112
N-HEXANE = 0.56000E-4

**** Initial Conditions ****

Temperature in tray no. 19 (F)	=	<u>174.56</u>
Liquid flow rate in tray no. 19 (moles/hr)	=	<u>1084.07</u>
Composition in tray no. 19 :		
PROPANE	=	<u>0.53920E-1</u>
ISOBUTANE	=	<u>0.76500E-1</u>
N-BUTANE	=	<u>0.48680</u>
ISOPENTANE	=	<u>0.30943</u>
N-PENTANE	=	<u>0.73330E-1</u>
N-HEXANE	=	<u>0.16444E-4</u>

**** Initial Conditions ****

Temperature in tray no. 20 (F)	=	<u>168.98</u>
Liquid flow rate in tray no. 20 (moles/hr)	=	<u>1103.20</u>
Composition in tray no. 20 :		
PROPANE	=	<u>0.56720E-1</u>
ISOBUTANE	=	<u>0.86780E-1</u>
N-BUTANE	=	<u>0.56034</u>
ISOPENTANE	=	<u>0.24661</u>
N-PENTANE	=	<u>0.49550E-1</u>
N-HEXANE	=	<u>0.44520E-5</u>

**** Initial Conditions ****

Temperature in tray no. 21 (F) = 163.76
Liquid flow rate in tray no. 21 (moles/hr) = 1124.78
Composition in tray no. 21 :
PROPANE = 0.60210E-1
ISOBUTANE = 0.98770E-1
N-BUTANE = 0.62729
ISOPENTANE = 0.18266
N-PENTANE = 0.31070E-1
N-HEXANE = 0.11078E-5

**** Initial Conditions ****

Temperature in tray no. 22 (F) = 159.08
Liquid flow rate in tray no. 22 (moles/hr) = 1145.69
Composition in tray no. 22 :
PROPANE = 0.65750E-1
ISOBUTANE = 0.11254
N-BUTANE = 0.67784
ISOPENTANE = 0.12578
N-PENTANE = 0.18100E-1
N-HEXANE = 0.25452E-6

**** Initial Conditions ****

Temperature in tray no. 23 (F) = 154.40

Liquid flow rate in tray no. 23 (moles/hr) = 2364.0

Composition in tray no. 23 :

PROPANE = 0.77530E-1

ISOBUTANE = 0.12824

N-BUTANE = 0.70388

ISOPENTANE = 0.80540E-1

N-PENTANE = 0.98100E-2

N-HEXANE = 0.54373E-7

**** Initial Conditions ****

Temperature in tray no. 24 (F) = 148.46

Liquid flow rate in tray no. 24 (moles/hr) = 1173.29

Composition in tray no. 24 :

PROPANE = 0.10685

ISOBUTANE = 0.14526

N-BUTANE = 0.69558

ISOPENTANE = 0.47410E-1

N-PENTANE = 0.48900E-2

N-HEXANE = 0.10765E-7

**** Initial Conditions ****

Temperature in tray no. 25 (F) = 137.84

Liquid flow rate in tray no. 25 (moles/hr) = 1170.40

Composition in tray no. 25 :

PROPANE = 0.18133

ISOBUTANE = 0.15923

N-BUTANE = 0.63291

ISOPENTANE = 0.24400E-1

N-PENTANE = 0.21300E-2

N-HEXANE = 0.18784E-8

**** Initial Conditions ****

Temperature in reflux drum TD, (F) = 290.66

Composition in reflux drum :

PROPANE = 0.35394

ISOBUTANE = 0.15614

N-BUTANE = 0.48014

ISOPENTANE = 0.91300E-2

N-PENTANE = 0.65312E-3

N-HEXANE = 0.21086E-9

Press ENTER to continue

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**** MAIN MENU ****

0) Exit to Dos
1) Components Database
2) Characteristic of Column
3) Operating Conditions
4) Feed Data
5) Initial Conditions
6) Edit Input Data
7) Save Input data
8) Run
9) Reporting & Reviewing the results

Please ENTER your selection : 8
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Step 3 : Output of Results

After the run selection from main menu the results for each time appered in the RESULT.DAT file and it can be printout by using an editor programming. The results show the composition in various times.