Universitat de les Illes Balears

Escola Politècnica Superior

21719 - Avaluació del Comportament de Sistemes Informàtics.

Actividad 5: Tema 5 - Aplicaciones del Análisis Operacional

Parte 1

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Cambiad el modelo y los parámetros del mismo para que al ejecutar vuestro nuevo modelo en QNAP la tabla de resultados demuestre que es lo mismo que al realizar el problema (ver solución en la tabla 5.2 en el libro).

a. *Programad el cálculo de las demandas de los 2 dispositivos, y la demanda total (D) y su impresión. ¿Cuál es el cuello de botella (Db)? ¿Cuál es el punto de saturación (N*)? Imprimid todas esas variables.*

```
NUMERO DE USUARIOS=       10
- MEAN VALUE ANALYSIS ("MVA") -
*************************************************************************
*   NAME    *  SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*************************************************************************
*           *          *          *          *          *          *
*CPU        *0.3000E-01*0.2412    *0.3074    *0.3824E-01* 8.039    *
*           *          *          *          *          *          *
*DISC       *0.1000    *0.7034    * 1.653    *0.2350    * 7.034    *
*           *          *          *          *          *          *
*TERMINAL   * 8.000    *0.0000E+00* 8.039    * 8.000    * 1.005    *
*           *          *          *          *          *          *
*************************************************************************
             MEMORY USED:       7000 WORDS OF 4 BYTES
              (  0.14  % OF TOTAL MEMORY)
CALCULO DE DEMANDAS
DEMANDA DE LA CPU =   0.2400
DEMANDA DEL DISCO =   0.7000
DEMANDA TOTAL DEL SISITEMA =   0.9400

EL CUELLO DE BOTELLA Db ES:   0.7000
EL PUNTO DE SATURACIÓN N =        13
    37 /END/
```

b. *b. Programad el cálculo del tiempo de respuesta del sistema (R) y el tiempo TOTAL (R+Z), así como el número de usuarios trabajando y reflexionando (imprimid los valores).*

El tiempo de respuesta del sistema (R) se calcula de acuerdo con la fórmula $R = \frac{N}{X} - Z$ la ley del tiempo de respuesta interactiva, donde N es el número de usuarios del sistema, X es la productividad total del sistema, y Z es el tiempo de reflexión de los usuarios.

```
NUMERO DE USUARIOS=       10
TIEMPO DE RESPUESTA DEL SISTEMA (R)=    1.951
TIEMPO TOTAL (R+Z) =    9.951
NÚMERO DE USUARIOS TRBAJANDO =    1.961
TIEMPO DE USUARIOS REFLEXIONANDO=    8.039
    29 /END/
```

c. *Volved a vuestro modelo original y cread otro disco gemelo al original (7 visitas) y equilibrad las cargas, ¿qué variaciones se observan en los cálculos?*

Hemos creado un disco gemelo con el mismo tiempo de servicio que el disco original (S =0.1) y para igualar las visitas hemos dividido el numero de visitas total (7) en dos, ya que si los discos van a tener el mismo tiempo de servicio deben tener también el mismo numero de visitas de acuerdo con lo siguiente:

$V_{disco1} * S_{disco1} = V_{disco2} * S_{disco2}$

$\frac{V_{disco1}}{V_{disco2}} = \frac{S_{disco2}}{S_{disco1}} \rightarrow i\ S_{disco2} = S_{disco1}\ tenemos\ que\ \frac{V_{discoa}}{V_{disco2}} = 1 \rightarrow V_{disco1} = V_{disco2}$

Por lo tanto cada disco tindrá 3.5 visitas.

Los resultados son los siguientes

```
 - MEAN VALUE ANALYSIS ("MVA") -
*************************************************************************
*   NAME    *  SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*************************************************************************
*           *          *          *          *          *          *
*CPU        *0.3000E-01*0.2568    *0.3317    *0.3874E-01* 8.562    *
*           *          *          *          *          *          *
*DISC   1   *0.1000    *0.3746    *0.5534    *0.1477    * 3.746    *
*           *          *          *          *          *          *
*DISC   2   *0.1000    *0.3746    *0.5534    *0.1477    * 3.746    *
*           *          *          *          *          *          *
*TERMINAL   * 8.000    *0.0000E+00* 8.562    * 8.000    * 1.070    *
*           *          *          *          *          *          *
*************************************************************************
             MEMORY USED:       7162 WORDS OF 4 BYTES
              (  0.14  % OF TOTAL MEMORY)
NUMERO DE USUARIOS=       10
TIEMPO DE RESPUESTA DEL SISTEMA (R)=    1.344
TIEMPO TOTAL (R+Z) =    9.344
NÚMERO DE USUARIOS TRBAJANDO =    1.438
TIEMPO DE USUARIOS REFLEXIONANDO=    8.562
    31 /END/
```

Notamos algunas fluctuaciones en las productividades de la CPU y el terminal, ya que la nueva distribución de las cargas entre ambos discos no garantiza que las productividades sean exactamente iguales que las del modelo original.

En concreto la productividad de la CPU y el terminal o el sistema en general ambas han aumentado un 0.93 veces.

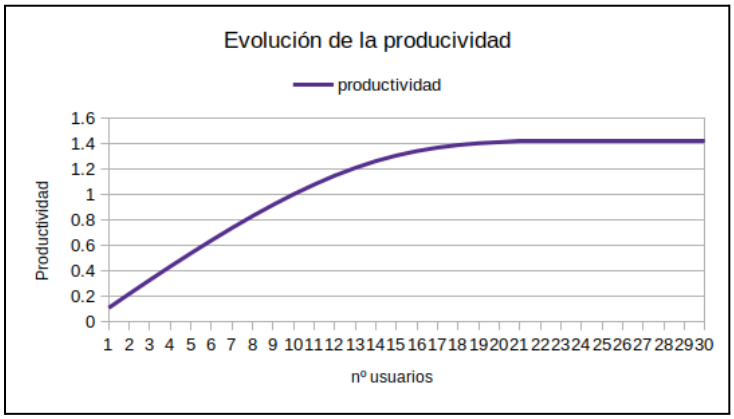
Estos cambios de la productividad afectaron también al número de usuarios en la cola (CUST NB) dado que dicho factor es directamente proporcional a la productividad del sisitema.

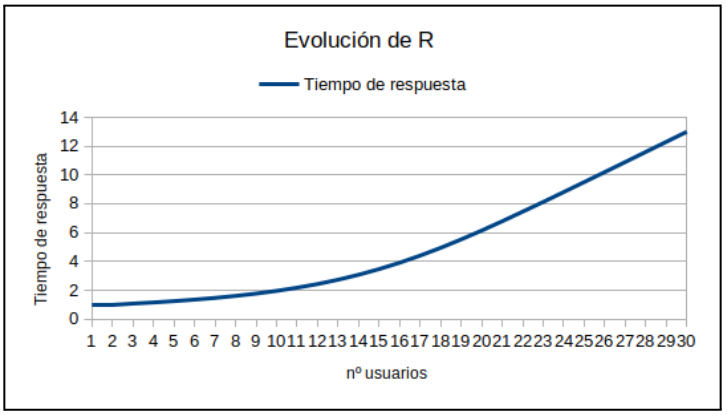
La utilización de al CPU también ha aumentado gracias al aumento de la productividad de la misma.

También hemos notado una disminución en el tiempo de respuesta del sistema, aproximadamente en un 1.45 veces, gracias a la disminución de la productividad del sistema.

En general, añadir un nuevo disco y equilibrar las cargas ha contribuido a mejorar el rendimiento general del sistema.

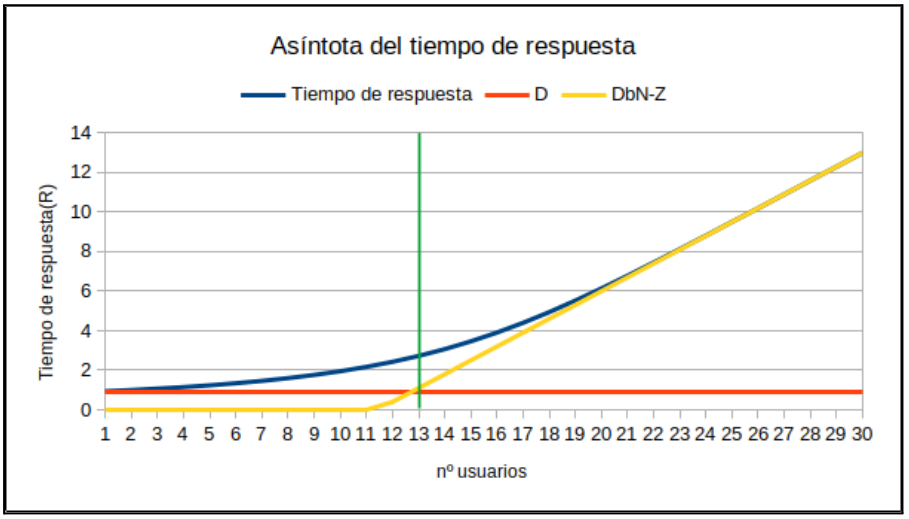
d. ***Volved a vuestro modelo original e iterad el modelo hasta 30 usuarios con saltos de 1 y construid una tabla .xls o similar y dos gráficas con líneas, en la que se vea la variación del tiempo de respuesta (R) y la productividad del sistema (X) con el número de usuarios***

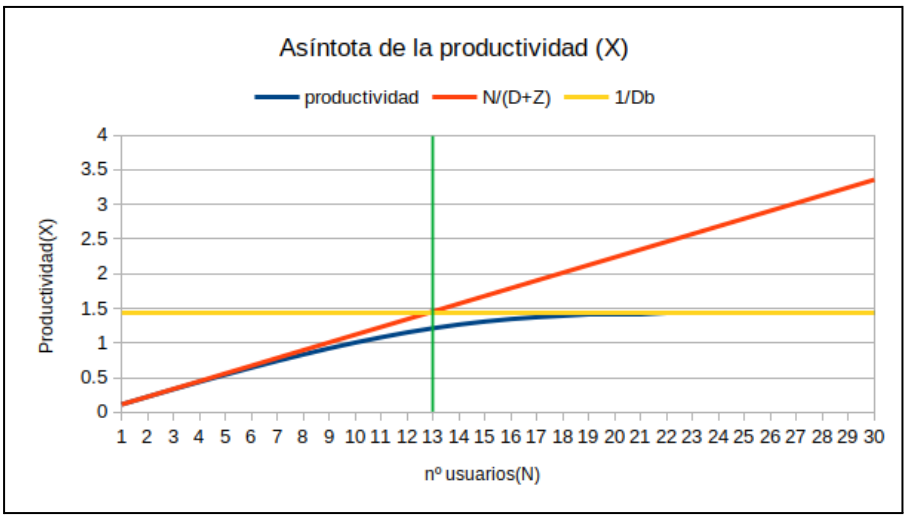




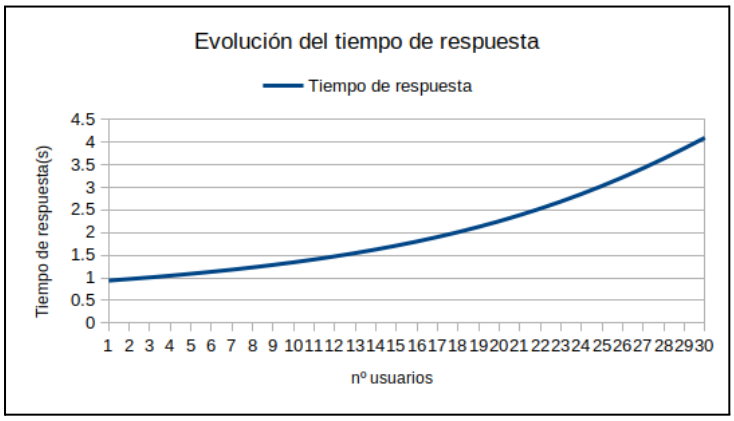
incremental.

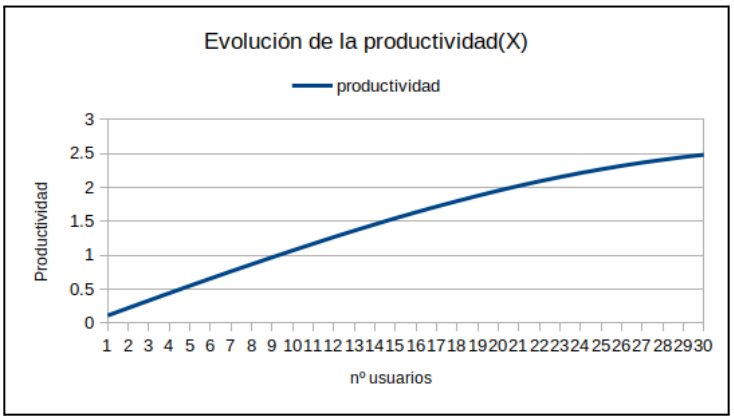
e. ***Representad las 2 asíntotas del modelo original en sendas gráficas y el N* (ver libro páginas 140 -141 o transparencias del tema 5).***

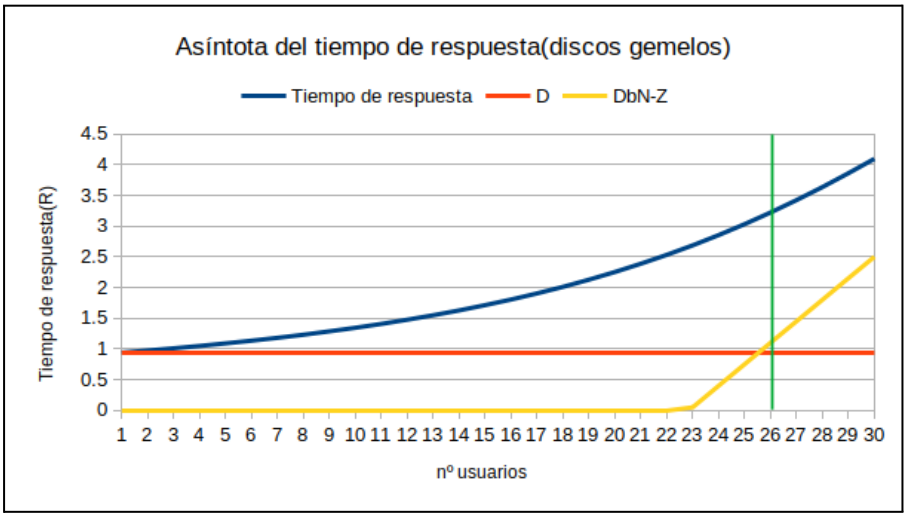


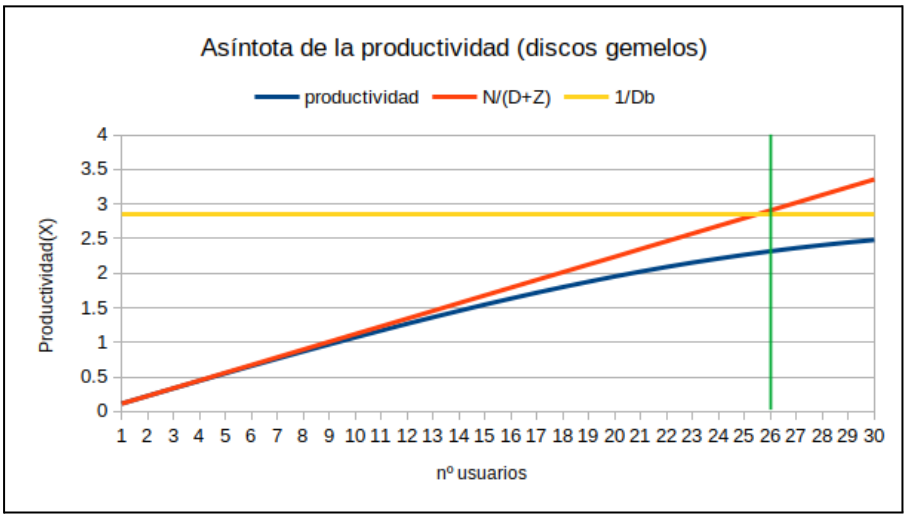


f. ***Realizad lo mismo que en el apartado d y e con el modelo de dos discos gemelos (apartado c).***









FICHEROS GENERADOS POR CADA APARTADO

apartadoA

```
 SIMULOG  ***  QNAP2  ***  ( 28-02-1999 ) V 9.4
 (C)  COPYRIGHT BY CII HONEYWELL BULL AND INRIA, 1986


    1 /DECLARE/ QUEUE CPU,DISC,TERMINAL;
    2       REAL PROB1=7.;
    3       REAL TTR1,TOTAL,WORK, VCPU, DCPU, DDISC, DTOTAL, DBOTTELA;
    4       INTEGER I,N1;
    5 /STATION/ NAME=CPU;
    6 &      SCHED=PS;
    7       SERVICE=EXP(0.03);
    8       TRANSIT=DISC,PROB1,TERMINAL,1;
    9 /STATION/ NAME=DISC;
   10                  SERVICE= EXP(0.1);
   11       TRANSIT=CPU;
   12 /STATION/ NAME=TERMINAL;
   13       TYPE=INFINITE;
   14       INIT=N1;
   15       SERVICE=EXP(8.);
   16       TRANSIT=CPU;
   17 /CONTROL/ CLASS=ALL QUEUE;
   18 /EXEC/   FOR N1:=10 STEP 10 UNTIL 10 DO
   19       BEGIN
   20        PRINT("NUMERO DE USUARIOS=",N1);
   21        SOLVE;
   22                           PRINT("CALCULO DE DEMANDAS");
   23                           VCPU:=PROB1+1;
   24                           DDISC:= MSERVICE(DISC)*PROB1;
   25                           DCPU:= VCPU*MSERVICE(CPU);
   26                           PRINT("DEMANDA DE LA CPU = ", DCPU);
   27                           PRINT("DEMANDA DEL DISCO = ", DDISC);
   28                           DTOTAL:= DCPU+DDISC;
   29                           PRINT("DEMANDA TOTAL DEL SISITEMA = ",DTOTAL );
   30                           PRINT(" ");
   31                           DBOTTELA:=  MAX(DCPU,DDISC);
   32                           PRINT("EL CUELLO DE BOTELLA Db ES: ", DBOTTELA);
   33                           PRINT("EL PUNTO DE SATURACIÓN N = ", INTROUND((DTOTAL+MSERVICE(TERMI
NAL))/DBOTTELA)  );
   34
   35
   36       END;
 NUMERO DE USUARIOS=     10
 - MEAN VALUE ANALYSIS ("MVA") -
 ****************************************************************
 *  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
 ****************************************************************
 *      *      *      *      *      *      *
 *CPU    *0.3000E-01*0.2412   *0.3074   *0.3824E-01* 8.039   *
 *      *      *      *      *      *      *
 *DISC    *0.1000   *0.7034   * 1.653   *0.2350   * 7.034   *
 *      *      *      *      *      *      *
 *TERMINAL  * 8.000   *0.0000E+00* 8.039   * 8.000   * 1.005   *
 *      *      *      *      *      *      *
```

```
****************************************************************
        MEMORY USED:     7000 WORDS OF 4 BYTES
        ( 0.14 % OF TOTAL MEMORY)
CALCULO DE DEMANDAS
DEMANDA DE LA CPU =   0.2400
DEMANDA DEL DISCO =   0.7000
DEMANDA TOTAL DEL SISITEMA =   0.9400

EL CUELLO DE BOTELLA Db ES:  0.7000
EL PUNTO DE SATURACIÓN N =      13
  37 /END/
```

---

apartado B

```
 SIMULOG  *** QNAP2 *** ( 28-02-1999 ) V 9.4
 (C) COPYRIGHT BY CII HONEYWELL BULL AND INRIA, 1986
    1 /DECLARE/ QUEUE CPU,DISC,TERMINAL;
    2       REAL PROB1=7.;
    3       REAL R;
    4       INTEGER N1;
    5 /STATION/ NAME=CPU;
    6 &      SCHED=PS;
    7       SERVICE=EXP(0.03);
    8       TRANSIT=DISC,PROB1,TERMINAL,1;
    9 /STATION/ NAME=DISC;
   10                  SERVICE= EXP(0.1);
   11       TRANSIT=CPU;
   12 /STATION/ NAME=TERMINAL;
   13       TYPE=INFINITE;
   14       INIT=N1;
   15       SERVICE=EXP(8.);
   16       TRANSIT=CPU;
   17 /CONTROL/ CLASS=ALL QUEUE;
   18 /EXEC/   FOR N1:=10 STEP 10 UNTIL 10 DO
   19       BEGIN
   20        SOLVE;
   21                          PRINT("NUMERO DE USUARIOS=",N1);
   22                          R:= (N1/MTHRUPUT(TERMINAL))-MSERVICE(TERMINAL);
   23                          PRINT("TIEMPO DE RESPUESTA DEL SISTEMA (R)= ", R);
   24                          PRINT("TIEMPO TOTAL (R+Z) = ", R+MSERVICE(TERMINAL));
   25                          PRINT("NÚMERO DE USUARIOS TRBAJANDO = ", N1-MCUSTNB(TERMINAL));
   26                          PRINT("TIEMPO DE USUARIOS REFLEXIONANDO= ", MCUSTNB(TERMINAL));
   27
   28       END;
- MEAN VALUE ANALYSIS ("MVA") -
****************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
****************************************************************
*      *      *      *      *      *      *
*CPU    *0.3000E-01*0.2412   *0.3074   *0.3824E-01* 8.039   *
*      *      *      *      *      *      *
*DISC   *0.1000   *0.7034   * 1.653   *0.2350   * 7.034   *
*      *      *      *      *      *      *
*TERMINAL * 8.000   *0.0000E+00* 8.039   * 8.000   * 1.005   *
*      *      *      *      *      *      *
****************************************************************
```

```
        MEMORY USED:     6858 WORDS OF 4 BYTES
        ( 0.14 % OF TOTAL MEMORY)
NUMERO DE USUARIOS=     10
TIEMPO DE RESPUESTA DEL SISTEMA (R)=   1.951
TIEMPO TOTAL (R+Z) =   9.951
NÚMERO DE USUARIOS TRBAJANDO =   1.961
TIEMPO DE USUARIOS REFLEXIONANDO=   8.039
  29 /END/
```

---

apartado C

```
 SIMULOG  *** QNAP2 *** ( 28-02-1999 ) V 9.4
 (C) COPYRIGHT BY CII HONEYWELL BULL AND INRIA, 1986
    1 /DECLARE/ QUEUE CPU,DISC(2),TERMINAL;
    2       REAL PROB1(2)=(3.5,3.5);
    3       REAL R;
    4       INTEGER N1;
    5 /STATION/ NAME=CPU;
    6       SERVICE=EXP(0.03);
    7       TRANSIT=DISC,PROB1,TERMINAL,1;
    8 /STATION/ NAME=DISC;
    9                           TRANSIT = CPU;
   10 /STATION/ NAME = DISC(1);
   11                   SERVICE= EXP(0.1);
   12 /STATION/ NAME = DISC(2);
   13                   SERVICE= EXP(0.1);
   14 /STATION/ NAME=TERMINAL;
   15       TYPE=INFINITE;
   16       INIT=N1;
   17       SERVICE=EXP(8.);
   18       TRANSIT=CPU;
   19 /CONTROL/ CLASS=ALL QUEUE;
   20 /EXEC/   FOR N1:=10 STEP 10 UNTIL 10 DO
   21       BEGIN
   22        SOLVE;
   23                           PRINT("NUMERO DE USUARIOS=",N1);
   24                           R:= (N1/MTHRUPUT(TERMINAL))-MSERVICE(TERMINAL);
   25                           PRINT("TIEMPO DE RESPUESTA DEL SISTEMA (R)= ", R);
   26                           PRINT("TIEMPO TOTAL (R+Z) = ", R+MSERVICE(TERMINAL));
   27                           PRINT("NÚMERO DE USUARIOS TRBAJANDO = ", N1-MCUSTNB(TERMINAL));
   28                           PRINT("TIEMPO DE USUARIOS REFLEXIONANDO= ", MCUSTNB(TERMINAL));
   29
   30       END;
- MEAN VALUE ANALYSIS ("MVA") -
*****************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*****************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.2568   *0.3317   *0.3874E-01* 8.562   *
*      *      *      *      *      *      *
*DISC  1 *0.1000   *0.3746   *0.5534   *0.1477   * 3.746   *
*      *      *      *      *      *      *
*DISC  2 *0.1000   *0.3746   *0.5534   *0.1477   * 3.746   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 8.562   * 8.000   * 1.070   *
*      *      *      *      *      *      *
```

```
*****************************************************************
        MEMORY USED:     7162 WORDS OF 4 BYTES
        ( 0.14 % OF TOTAL MEMORY)
NUMERO DE USUARIOS=      10
TIEMPO DE RESPUESTA DEL SISTEMA (R)=    1.344
TIEMPO TOTAL (R+Z) =    9.344
NÚMERO DE USUARIOS TRBAJANDO =    1.438
TIEMPO DE USUARIOS REFLEXIONANDO=    8.562
  31 /END/
```

---

apartado d

```
 SIMULOG  *** QNAP2 *** ( 28-02-1999 ) V 9.4
 (C) COPYRIGHT BY CII HONEYWELL BULL AND INRIA, 1986
    1 /DECLARE/ QUEUE CPU,DISC,TERMINAL;
    2       REAL PROB1=7.;
    3       REAL R;
    4       INTEGER I,N1;
    5 /STATION/ NAME=CPU;
    6 &      SCHED=PS;
    7       SERVICE=EXP(0.03);
    8       TRANSIT=DISC,PROB1,TERMINAL,1;
    9 /STATION/ NAME=DISC;
   10                  SERVICE= EXP(0.1);
   11       TRANSIT=CPU;
   12 /STATION/ NAME=TERMINAL;
   13       TYPE=INFINITE;
   14       INIT=N1;
   15       SERVICE=EXP(8.);
   16       TRANSIT=CPU;
   17 /CONTROL/ CLASS=ALL QUEUE;
   18 /EXEC/   FOR N1:=1 STEP 1 UNTIL 30 DO
   19       BEGIN
   20        SOLVE;
   21                           PRINT("APARTADO D");
   22                           PRINT("NUMERO DE USUARIOS=",N1);
   23                           R:= (N1/MTHRUPUT(TERMINAL))-MSERVICE(TERMINAL);
   24                           PRINT("TIEMPO DE RESPUESTA DEL SISTEMA (R)= ", R);
   25                           PRINT("PRODUCTIVIDAD DEL SISTEMA (X0)= ", MTHRUPUT(TERMINAL));
   26       END;
- MEAN VALUE ANALYSIS ("MVA") -
*****************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*****************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.2685E-01*0.2685E-01*0.3000E-01*0.8949   *
*      *      *      *      *      *      *
*DISC    *0.1000   *0.7830E-01*0.7830E-01*0.1000   *0.7830   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00*0.8949   * 8.000   *0.1119   *
*      *      *      *      *      *      *
*****************************************************************
        MEMORY USED:     6862 WORDS OF 4 BYTES
        ( 0.14 % OF TOTAL MEMORY)
APARTADO D
NUMERO DE USUARIOS=      1
TIEMPO DE RESPUESTA DEL SISTEMA (R)=  0.9400
```

```
PRODUCTIVIDAD DEL SISTEMA (X0)=  0.1119
- MEAN VALUE ANALYSIS ("MVA") -
*****************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*****************************************************************
*     *     *     *     *     *     *
*CPU    *0.3000E-01*0.5333E-01*0.5476E-01*0.3081E-01* 1.778   *
*     *     *     *     *     *     *
*DISC   *0.1000   *0.1555   *0.1677   *0.1078   * 1.555   *
*     *     *     *     *     *     *
*TERMINAL  * 8.000   *0.0000E+00* 1.778   * 8.000   *0.2222   *
*     *     *     *     *     *     *
*****************************************************************
        MEMORY USED:     6888 WORDS OF 4 BYTES
        ( 0.14  % OF TOTAL MEMORY)
APARTADO D
NUMERO DE USUARIOS=      2
TIEMPO DE RESPUESTA DEL SISTEMA (R)=   1.001
PRODUCTIVIDAD DEL SISTEMA (X0)=  0.2222
- MEAN VALUE ANALYSIS ("MVA") -
*****************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*****************************************************************
*     *     *     *     *     *     *
*CPU    *0.3000E-01*0.7938E-01*0.8372E-01*0.3164E-01* 2.646   *
*     *     *     *     *     *     *
*DISC   *0.1000   *0.2315   *0.2703   *0.1168   * 2.315   *
*     *     *     *     *     *     *
*TERMINAL  * 8.000   *0.0000E+00* 2.646   * 8.000   *0.3307   *
*     *     *     *     *     *     *
*****************************************************************
        MEMORY USED:     6914 WORDS OF 4 BYTES
        ( 0.14  % OF TOTAL MEMORY)
APARTADO D
NUMERO DE USUARIOS=      3
TIEMPO DE RESPUESTA DEL SISTEMA (R)=   1.071
PRODUCTIVIDAD DEL SISTEMA (X0)=  0.3307
- MEAN VALUE ANALYSIS ("MVA") -
*****************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*****************************************************************
*     *     *     *     *     *     *
*CPU    *0.3000E-01*0.1049   *0.1137   *0.3251E-01* 3.498   *
*     *     *     *     *     *     *
*DISC   *0.1000   *0.3060   *0.3888   *0.1270   * 3.060   *
*     *     *     *     *     *     *
*TERMINAL  * 8.000   *0.0000E+00* 3.498   * 8.000   *0.4372   *
*     *     *     *     *     *     *
*****************************************************************
        MEMORY USED:     6940 WORDS OF 4 BYTES
        ( 0.14  % OF TOTAL MEMORY)
APARTADO D
NUMERO DE USUARIOS=      4
TIEMPO DE RESPUESTA DEL SISTEMA (R)=   1.149
PRODUCTIVIDAD DEL SISTEMA (X0)=  0.4372
- MEAN VALUE ANALYSIS ("MVA") -
```

```
*****************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*****************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.1299   *0.1446   *0.3341E-01* 4.329   *
*      *      *      *      *      *      *
*DISC    *0.1000   *0.3788   *0.5261   *0.1389   * 3.788   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 4.329   * 8.000   *0.5412   *
*      *      *      *      *      *      *
*****************************************************************
        MEMORY USED:     6966 WORDS OF 4 BYTES
        ( 0.14 % OF TOTAL MEMORY)
APARTADO D
NUMERO DE USUARIOS=      5
TIEMPO DE RESPUESTA DEL SISTEMA (R)=   1.239
PRODUCTIVIDAD DEL SISTEMA (X0)=  0.5412
- MEAN VALUE ANALYSIS ("MVA") -
*****************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*****************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.1541   *0.1764   *0.3434E-01* 5.138   *
*      *      *      *      *      *      *
*DISC    *0.1000   *0.4495   *0.6860   *0.1526   * 4.495   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 5.138   * 8.000   *0.6422   *
*      *      *      *      *      *      *
*****************************************************************
        MEMORY USED:     6992 WORDS OF 4 BYTES
        ( 0.14 % OF TOTAL MEMORY)
APARTADO D
NUMERO DE USUARIOS=      6
TIEMPO DE RESPUESTA DEL SISTEMA (R)=   1.343
PRODUCTIVIDAD DEL SISTEMA (X0)=  0.6422
- MEAN VALUE ANALYSIS ("MVA") -
*****************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*****************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.1775   *0.2089   *0.3529E-01* 5.918   *
*      *      *      *      *      *      *
*DISC    *0.1000   *0.5178   *0.8731   *0.1686   * 5.178   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 5.918   * 8.000   *0.7398   *
*      *      *      *      *      *      *
*****************************************************************
        MEMORY USED:     7018 WORDS OF 4 BYTES
        ( 0.14 % OF TOTAL MEMORY)
APARTADO D
NUMERO DE USUARIOS=      7
TIEMPO DE RESPUESTA DEL SISTEMA (R)=   1.463
PRODUCTIVIDAD DEL SISTEMA (X0)=  0.7398
- MEAN VALUE ANALYSIS ("MVA") -
*****************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
```

```
*****************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.2000   *0.2417   *0.3627E-01* 6.666   *
*      *      *      *      *      *      *
*DISC    *0.1000   *0.5833   * 1.092   *0.1873   * 5.833   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 6.666   * 8.000   *0.8332   *
*      *      *      *      *      *      *
*****************************************************************
        MEMORY USED:     7044 WORDS OF 4 BYTES
        ( 0.14 % OF TOTAL MEMORY)
APARTADO D
NUMERO DE USUARIOS=      8
TIEMPO DE RESPUESTA DEL SISTEMA (R)=   1.601
PRODUCTIVIDAD DEL SISTEMA (X0)=  0.8332
- MEAN VALUE ANALYSIS ("MVA") -
*****************************************************************
*  NAME  *  SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*****************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.2212   *0.2747   *0.3725E-01* 7.375   *
*      *      *      *      *      *      *
*DISC    *0.1000   *0.6453   * 1.350   *0.2092   * 6.453   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 7.375   * 8.000   *0.9219   *
*      *      *      *      *      *      *
*****************************************************************
        MEMORY USED:     7070 WORDS OF 4 BYTES
        ( 0.14 % OF TOTAL MEMORY)
APARTADO D
NUMERO DE USUARIOS=      9
TIEMPO DE RESPUESTA DEL SISTEMA (R)=   1.763
PRODUCTIVIDAD DEL SISTEMA (X0)=  0.9219
- MEAN VALUE ANALYSIS ("MVA") -
*****************************************************************
*  NAME  *  SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*****************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.2412   *0.3074   *0.3824E-01* 8.039   *
*      *      *      *      *      *      *
*DISC    *0.1000   *0.7034   * 1.653   *0.2350   * 7.034   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 8.039   * 8.000   * 1.005   *
*      *      *      *      *      *      *
*****************************************************************
        MEMORY USED:     7096 WORDS OF 4 BYTES
        ( 0.14 % OF TOTAL MEMORY)
APARTADO D
NUMERO DE USUARIOS=     10
TIEMPO DE RESPUESTA DEL SISTEMA (R)=   1.951
PRODUCTIVIDAD DEL SISTEMA (X0)=   1.005
- MEAN VALUE ANALYSIS ("MVA") -
*****************************************************************
*  NAME  *  SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*****************************************************************
*      *      *      *      *      *      *
```

```
*CPU     *0.3000E-01*0.2596   *0.3394   *0.3922E-01* 8.652   *
*      *      *      *      *      *      *
*DISC    *0.1000   *0.7570   * 2.009   *0.2653   * 7.570   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 8.652   * 8.000   * 1.081   *
*      *      *      *      *      *      *
*********************************************************************
        MEMORY USED:     7122 WORDS OF 4 BYTES
        ( 0.14 % OF TOTAL MEMORY)
APARTADO D
NUMERO DE USUARIOS=     11
TIEMPO DE RESPUESTA DEL SISTEMA (R)=   2.171
PRODUCTIVIDAD DEL SISTEMA (X0)=   1.081
- MEAN VALUE ANALYSIS ("MVA") -
*********************************************************************
*  NAME  *  SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*********************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.2762   *0.3699   *0.4018E-01* 9.206   *
*      *      *      *      *      *      *
*DISC    *0.1000   *0.8056   * 2.424   *0.3009   * 8.056   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 9.206   * 8.000   * 1.151   *
*      *      *      *      *      *      *
*********************************************************************
        MEMORY USED:     7148 WORDS OF 4 BYTES
        ( 0.14 % OF TOTAL MEMORY)
APARTADO D
NUMERO DE USUARIOS=     12
TIEMPO DE RESPUESTA DEL SISTEMA (R)=   2.428
PRODUCTIVIDAD DEL SISTEMA (X0)=   1.151
- MEAN VALUE ANALYSIS ("MVA") -
*********************************************************************
*  NAME  *  SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*********************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.2909   *0.3985   *0.4110E-01* 9.697   *
*      *      *      *      *      *      *
*DISC    *0.1000   *0.8485   * 2.905   *0.3424   * 8.485   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 9.697   * 8.000   * 1.212   *
*      *      *      *      *      *      *
*********************************************************************
        MEMORY USED:     7174 WORDS OF 4 BYTES
        ( 0.14 % OF TOTAL MEMORY)
APARTADO D
NUMERO DE USUARIOS=     13
TIEMPO DE RESPUESTA DEL SISTEMA (R)=   2.725
PRODUCTIVIDAD DEL SISTEMA (X0)=   1.212
- MEAN VALUE ANALYSIS ("MVA") -
*********************************************************************
*  NAME  *  SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*********************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.3035   *0.4245   *0.4196E-01* 10.12   *
*      *      *      *      *      *      *
```

```
*DISC    *0.1000   *0.8854   * 3.457   *0.3905   * 8.854   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 10.12   * 8.000   * 1.265   *
*      *      *      *      *      *      *
*********************************************************************
        MEMORY USED:     7200 WORDS OF 4 BYTES
        ( 0.14 % OF TOTAL MEMORY)
APARTADO D
NUMERO DE USUARIOS=     14
TIEMPO DE RESPUESTA DEL SISTEMA (R)=   3.069
PRODUCTIVIDAD DEL SISTEMA (X0)=   1.265
- MEAN VALUE ANALYSIS ("MVA") -
*********************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*********************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.3141   *0.4474   *0.4274E-01* 10.47   *
*      *      *      *      *      *      *
*DISC    *0.1000   *0.9161   * 4.083   *0.4457   * 9.161   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 10.47   * 8.000   * 1.309   *
*      *      *      *      *      *      *
*********************************************************************
        MEMORY USED:     7226 WORDS OF 4 BYTES
        ( 0.14 % OF TOTAL MEMORY)
APARTADO D
NUMERO DE USUARIOS=     15
TIEMPO DE RESPUESTA DEL SISTEMA (R)=   3.462
PRODUCTIVIDAD DEL SISTEMA (X0)=   1.309
- MEAN VALUE ANALYSIS ("MVA") -
*********************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*********************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.3225   *0.4668   *0.4342E-01* 10.75   *
*      *      *      *      *      *      *
*DISC    *0.1000   *0.9407   * 4.782   *0.5083   * 9.407   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 10.75   * 8.000   * 1.344   *
*      *      *      *      *      *      *
*********************************************************************
        MEMORY USED:     7252 WORDS OF 4 BYTES
        ( 0.15 % OF TOTAL MEMORY)
APARTADO D
NUMERO DE USUARIOS=     16
TIEMPO DE RESPUESTA DEL SISTEMA (R)=   3.906
PRODUCTIVIDAD DEL SISTEMA (X0)=   1.344
- MEAN VALUE ANALYSIS ("MVA") -
*********************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*********************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.3290   *0.4827   *0.4401E-01* 10.97   *
*      *      *      *      *      *      *
*DISC    *0.1000   *0.9597   * 5.549   *0.5782   * 9.597   *
*      *      *      *      *      *      *
```

```
*TERMINAL  * 8.000   *0.0000E+00* 10.97   * 8.000   * 1.371   *
*      *      *      *      *      *      *
****************************************************************
        MEMORY USED:     7278 WORDS OF 4 BYTES
        ( 0.15  % OF TOTAL MEMORY)
APARTADO D
NUMERO DE USUARIOS=     17
TIEMPO DE RESPUESTA DEL SISTEMA (R)=   4.399
PRODUCTIVIDAD DEL SISTEMA (X0)=   1.371
- MEAN VALUE ANALYSIS ("MVA") -
****************************************************************
*  NAME   *  SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
****************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.3338   *0.4950   *0.4448E-01* 11.13   *
*      *      *      *      *      *      *
*DISC    *0.1000   *0.9737   * 6.377   *0.6549   * 9.737   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 11.13   * 8.000   * 1.391   *
*      *      *      *      *      *      *
****************************************************************
        MEMORY USED:     7304 WORDS OF 4 BYTES
        ( 0.15  % OF TOTAL MEMORY)
APARTADO D
NUMERO DE USUARIOS=     18
TIEMPO DE RESPUESTA DEL SISTEMA (R)=   4.940
PRODUCTIVIDAD DEL SISTEMA (X0)=   1.391
- MEAN VALUE ANALYSIS ("MVA") -
****************************************************************
*  NAME   *  SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
****************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.3372   *0.5041   *0.4485E-01* 11.24   *
*      *      *      *      *      *      *
*DISC    *0.1000   *0.9835   * 7.255   *0.7377   * 9.835   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 11.24   * 8.000   * 1.405   *
*      *      *      *      *      *      *
****************************************************************
        MEMORY USED:     7330 WORDS OF 4 BYTES
        ( 0.15  % OF TOTAL MEMORY)
APARTADO D
NUMERO DE USUARIOS=     19
TIEMPO DE RESPUESTA DEL SISTEMA (R)=   5.523
PRODUCTIVIDAD DEL SISTEMA (X0)=   1.405
- MEAN VALUE ANALYSIS ("MVA") -
****************************************************************
*  NAME   *  SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
****************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.3395   *0.5106   *0.4512E-01* 11.32   *
*      *      *      *      *      *      *
*DISC    *0.1000   *0.9901   * 8.174   *0.8255   * 9.901   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 11.32   * 8.000   * 1.414   *
*      *      *      *      *      *      *
```

```
*****************************************************************
        MEMORY USED:     7356 WORDS OF 4 BYTES
        ( 0.15  % OF TOTAL MEMORY)
APARTADO D
NUMERO DE USUARIOS=     20
TIEMPO DE RESPUESTA DEL SISTEMA (R)=   6.140
PRODUCTIVIDAD DEL SISTEMA (X0)=   1.414
- MEAN VALUE ANALYSIS ("MVA") -
*****************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*****************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.3409   *0.5150   *0.4532E-01* 11.36   *
*      *      *      *      *      *      *
*DISC    *0.1000   *0.9943   * 9.122   *0.9174   * 9.943   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 11.36   * 8.000   * 1.420   *
*      *      *      *      *      *      *
*****************************************************************
        MEMORY USED:     7382 WORDS OF 4 BYTES
        ( 0.15  % OF TOTAL MEMORY)
APARTADO D
NUMERO DE USUARIOS=     21
TIEMPO DE RESPUESTA DEL SISTEMA (R)=   6.784
PRODUCTIVIDAD DEL SISTEMA (X0)=   1.420
- MEAN VALUE ANALYSIS ("MVA") -
*****************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*****************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.3418   *0.5178   *0.4545E-01* 11.39   *
*      *      *      *      *      *      *
*DISC    *0.1000   *0.9968   * 10.09   * 1.012   * 9.968   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 11.39   * 8.000   * 1.424   *
*      *      *      *      *      *      *
*****************************************************************
        MEMORY USED:     7408 WORDS OF 4 BYTES
        ( 0.15  % OF TOTAL MEMORY)
APARTADO D
NUMERO DE USUARIOS=     22
TIEMPO DE RESPUESTA DEL SISTEMA (R)=   7.449
PRODUCTIVIDAD DEL SISTEMA (X0)=   1.424
- MEAN VALUE ANALYSIS ("MVA") -
*****************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*****************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.3423   *0.5195   *0.4553E-01* 11.41   *
*      *      *      *      *      *      *
*DISC    *0.1000   *0.9983   * 11.07   * 1.109   * 9.983   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 11.41   * 8.000   * 1.426   *
*      *      *      *      *      *      *
*****************************************************************
        MEMORY USED:     7434 WORDS OF 4 BYTES
```

```
        ( 0.15  % OF TOTAL MEMORY)
APARTADO D
NUMERO DE USUARIOS=     23
TIEMPO DE RESPUESTA DEL SISTEMA (R)=   8.127
PRODUCTIVIDAD DEL SISTEMA (X0)=   1.426
- MEAN VALUE ANALYSIS ("MVA") -
****************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
****************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.3426   *0.5205   *0.4559E-01* 11.42   *
*      *      *      *      *      *      *
*DISC    *0.1000   *0.9991   * 12.06   * 1.207   * 9.991   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 11.42   * 8.000   * 1.427   *
*      *      *      *      *      *      *
****************************************************************
        MEMORY USED:     7460 WORDS OF 4 BYTES
        ( 0.15  % OF TOTAL MEMORY)
APARTADO D
NUMERO DE USUARIOS=     24
TIEMPO DE RESPUESTA DEL SISTEMA (R)=   8.814
PRODUCTIVIDAD DEL SISTEMA (X0)=   1.427
- MEAN VALUE ANALYSIS ("MVA") -
****************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
****************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.3427   *0.5211   *0.4562E-01* 11.42   *
*      *      *      *      *      *      *
*DISC    *0.1000   *0.9996   * 13.06   * 1.306   * 9.996   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 11.42   * 8.000   * 1.428   *
*      *      *      *      *      *      *
****************************************************************
        MEMORY USED:     7486 WORDS OF 4 BYTES
        ( 0.15  % OF TOTAL MEMORY)
APARTADO D
NUMERO DE USUARIOS=     25
TIEMPO DE RESPUESTA DEL SISTEMA (R)=   9.507
PRODUCTIVIDAD DEL SISTEMA (X0)=   1.428
- MEAN VALUE ANALYSIS ("MVA") -
****************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
****************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.3428   *0.5214   *0.4563E-01* 11.43   *
*      *      *      *      *      *      *
*DISC    *0.1000   *0.9998   * 14.05   * 1.406   * 9.998   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 11.43   * 8.000   * 1.428   *
*      *      *      *      *      *      *
****************************************************************
        MEMORY USED:     7512 WORDS OF 4 BYTES
        ( 0.15  % OF TOTAL MEMORY)
APARTADO D
```

```
NUMERO DE USUARIOS=     26
TIEMPO DE RESPUESTA DEL SISTEMA (R)=   10.20
PRODUCTIVIDAD DEL SISTEMA (X0)=   1.428
- MEAN VALUE ANALYSIS ("MVA") -
*****************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*****************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.3428   *0.5216   *0.4564E-01* 11.43   *
*      *      *      *      *      *      *
*DISC    *0.1000   *0.9999   * 15.05   * 1.505   * 9.999   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 11.43   * 8.000   * 1.428   *
*      *      *      *      *      *      *
*****************************************************************
        MEMORY USED:     7538 WORDS OF 4 BYTES
        ( 0.15  % OF TOTAL MEMORY)
APARTADO D
NUMERO DE USUARIOS=     27
TIEMPO DE RESPUESTA DEL SISTEMA (R)=   10.90
PRODUCTIVIDAD DEL SISTEMA (X0)=   1.428
- MEAN VALUE ANALYSIS ("MVA") -
*****************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*****************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.3428   *0.5217   *0.4565E-01* 11.43   *
*      *      *      *      *      *      *
*DISC    *0.1000   * 1.000   * 16.05   * 1.605   *10.000   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 11.43   * 8.000   * 1.429   *
*      *      *      *      *      *      *
*****************************************************************
        MEMORY USED:     7564 WORDS OF 4 BYTES
        ( 0.15  % OF TOTAL MEMORY)
APARTADO D
NUMERO DE USUARIOS=     28
TIEMPO DE RESPUESTA DEL SISTEMA (R)=   11.60
PRODUCTIVIDAD DEL SISTEMA (X0)=   1.429
- MEAN VALUE ANALYSIS ("MVA") -
*****************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*****************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.3429   *0.5217   *0.4565E-01* 11.43   *
*      *      *      *      *      *      *
*DISC    *0.1000   * 1.000   * 17.05   * 1.705   *10.000   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 11.43   * 8.000   * 1.429   *
*      *      *      *      *      *      *
*****************************************************************
        MEMORY USED:     7590 WORDS OF 4 BYTES
        ( 0.15  % OF TOTAL MEMORY)
APARTADO D
NUMERO DE USUARIOS=     29
TIEMPO DE RESPUESTA DEL SISTEMA (R)=   12.30
```

```
PRODUCTIVIDAD DEL SISTEMA (X0)=   1.429
- MEAN VALUE ANALYSIS ("MVA") -
*****************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*****************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.3429   *0.5217   *0.4565E-01* 11.43   *
*      *      *      *      *      *      *
*DISC    *0.1000   * 1.000   * 18.05   * 1.805   *10.000   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 11.43   * 8.000   * 1.429   *
*      *      *      *      *      *      *
*****************************************************************
        MEMORY USED:     7616 WORDS OF 4 BYTES
        ( 0.15  % OF TOTAL MEMORY)
APARTADO D
NUMERO DE USUARIOS=     30
TIEMPO DE RESPUESTA DEL SISTEMA (R)=   13.00
PRODUCTIVIDAD DEL SISTEMA (X0)=   1.429
  27 /END/
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apartado e

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SIMULOG  *** QNAP2  *** ( 28-02-1999 ) V 9.4
(C)  COPYRIGHT BY CII HONEYWELL BULL AND INRIA, 1986
   1 /DECLARE/ QUEUE CPU,DISC,TERMINAL;
   2       REAL PROB1=7.;
   3       REAL DDISC,DEMD1, DEMD2, PROD1, PROD2, VCPU, DCPU;
   4       INTEGER I,N1;
   5 /STATION/ NAME=CPU;
   6 &      SCHED=PS;
   7       SERVICE=EXP(0.03);
   8       TRANSIT=DISC,PROB1,TERMINAL,1;
   9 /STATION/ NAME=DISC;
  10                  SERVICE= EXP(0.1);
  11       TRANSIT=CPU;
  12 /STATION/ NAME=TERMINAL;
  13       TYPE=INFINITE;
  14       INIT=N1;
  15       SERVICE=EXP(8.);
  16       TRANSIT=CPU;
  17 /CONTROL/ CLASS=ALL QUEUE;
  18 /EXEC/   FOR N1:=1 STEP 1 UNTIL 30 DO
  19       BEGIN
  20        SOLVE;
  21                           PRINT("APARTADO E");
  22                           VCPU:=PROB1+1;
  23                DDISC:= MSERVICE(DISC)*PROB1;
  24                DCPU:= VCPU*MSERVICE(CPU);
  25                DEMD1:= DCPU+DDISC;
  26                           DEMD2:=(DDISC*N1)-MSERVICE(TERMINAL);
  27                           PRINT("D = ", DEMD1);
  28                           PRINT("DbN-Z= ", DEMD2);
  29                           PRINT("R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} = ", MAX(DEMD1,DEMD2));
  30                           PRINT("");
  31                           PROD1:=N1/(DEMD1+MSERVICE(TERMINAL));
```

```
  32                          PROD2:=1/(PROB1*MSERVICE(DISC));
  33                          PRINT("N/(D+Z) = ", PROD1);
  34                          PRINT("1/Db= ", PROD2);
  35                          PRINT("LA PRODUCTIVIDAD OPTIMA ES = ", MIN(PROD1,PROD2));
  36
  37       END;
- MEAN VALUE ANALYSIS ("MVA") -
**********************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
**********************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.2685E-01*0.2685E-01*0.3000E-01*0.8949   *
*      *      *      *      *      *      *
*DISC    *0.1000   *0.7830E-01*0.7830E-01*0.1000   *0.7830   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00*0.8949   * 8.000   *0.1119   *
*      *      *      *      *      *      *
**********************************************************************
        MEMORY USED:     7034 WORDS OF 4 BYTES
        ( 0.14  % OF TOTAL MEMORY)
APARTADO E
D =  0.9400
DbN-Z=  -7.300
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =  0.9400

N/(D+Z) =  0.1119
1/Db=   1.429
LA PRODUCTIVIDAD OPTIMA ES =  0.1119
- MEAN VALUE ANALYSIS ("MVA") -
**********************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
**********************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.5333E-01*0.5476E-01*0.3081E-01* 1.778   *
*      *      *      *      *      *      *
*DISC    *0.1000   *0.1555   *0.1677   *0.1078   * 1.555   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 1.778   * 8.000   *0.2222   *
*      *      *      *      *      *      *
**********************************************************************
        MEMORY USED:     7060 WORDS OF 4 BYTES
        ( 0.14  % OF TOTAL MEMORY)
APARTADO E
D =  0.9400
DbN-Z=  -6.600
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =  0.9400

N/(D+Z) =  0.2237
1/Db=   1.429
LA PRODUCTIVIDAD OPTIMA ES =  0.2237
- MEAN VALUE ANALYSIS ("MVA") -
**********************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
**********************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.7938E-01*0.8372E-01*0.3164E-01* 2.646   *
```

```
*      *      *      *      *      *      *
*DISC    *0.1000   *0.2315   *0.2703   *0.1168   * 2.315   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 2.646   * 8.000   *0.3307   *
*      *      *      *      *      *      *
****************************************************************
        MEMORY USED:     7086 WORDS OF 4 BYTES
        ( 0.14 % OF TOTAL MEMORY)
APARTADO E
D =  0.9400
DbN-Z=  -5.900
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =  0.9400

N/(D+Z) =  0.3356
1/Db=   1.429
LA PRODUCTIVIDAD OPTIMA ES =  0.3356
- MEAN VALUE ANALYSIS ("MVA") -
****************************************************************
*  NAME  *  SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
****************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.1049   *0.1137   *0.3251E-01* 3.498   *
*      *      *      *      *      *      *
*DISC    *0.1000   *0.3060   *0.3888   *0.1270   * 3.060   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 3.498   * 8.000   *0.4372   *
*      *      *      *      *      *      *
****************************************************************
        MEMORY USED:     7112 WORDS OF 4 BYTES
        ( 0.14 % OF TOTAL MEMORY)
APARTADO E
D =  0.9400
DbN-Z=  -5.200
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =  0.9400

N/(D+Z) =  0.4474
1/Db=   1.429
LA PRODUCTIVIDAD OPTIMA ES =  0.4474
- MEAN VALUE ANALYSIS ("MVA") -
****************************************************************
*  NAME  *  SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
****************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.1299   *0.1446   *0.3341E-01* 4.329   *
*      *      *      *      *      *      *
*DISC    *0.1000   *0.3788   *0.5261   *0.1389   * 3.788   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 4.329   * 8.000   *0.5412   *
*      *      *      *      *      *      *
****************************************************************
        MEMORY USED:     7138 WORDS OF 4 BYTES
        ( 0.14 % OF TOTAL MEMORY)
APARTADO E
D =  0.9400
DbN-Z=  -4.500
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =  0.9400
```

```
N/(D+Z) =  0.5593
1/Db=   1.429
LA PRODUCTIVIDAD OPTIMA ES =  0.5593
- MEAN VALUE ANALYSIS ("MVA") -
*****************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*****************************************************************
*      *      *      *      *      *      *
*CPU    *0.3000E-01*0.1541   *0.1764   *0.3434E-01* 5.138   *
*      *      *      *      *      *      *
*DISC   *0.1000   *0.4495   *0.6860   *0.1526   * 4.495   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 5.138   * 8.000   *0.6422   *
*      *      *      *      *      *      *
*****************************************************************
        MEMORY USED:     7164 WORDS OF 4 BYTES
        ( 0.14  % OF TOTAL MEMORY)
APARTADO E
D =  0.9400
DbN-Z=  -3.800
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =  0.9400

N/(D+Z) =  0.6711
1/Db=   1.429
LA PRODUCTIVIDAD OPTIMA ES =  0.6711
- MEAN VALUE ANALYSIS ("MVA") -
*****************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*****************************************************************
*      *      *      *      *      *      *
*CPU    *0.3000E-01*0.1775   *0.2089   *0.3529E-01* 5.918   *
*      *      *      *      *      *      *
*DISC   *0.1000   *0.5178   *0.8731   *0.1686   * 5.178   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 5.918   * 8.000   *0.7398   *
*      *      *      *      *      *      *
*****************************************************************
        MEMORY USED:     7190 WORDS OF 4 BYTES
        ( 0.14  % OF TOTAL MEMORY)
APARTADO E
D =  0.9400
DbN-Z=  -3.100
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =  0.9400

N/(D+Z) =  0.7830
1/Db=   1.429
LA PRODUCTIVIDAD OPTIMA ES =  0.7830
- MEAN VALUE ANALYSIS ("MVA") -
*****************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*****************************************************************
*      *      *      *      *      *      *
*CPU    *0.3000E-01*0.2000   *0.2417   *0.3627E-01* 6.666   *
*      *      *      *      *      *      *
*DISC   *0.1000   *0.5833   * 1.092   *0.1873   * 5.833   *
```

```
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 6.666   * 8.000   *0.8332   *
*      *      *      *      *      *      *
**********************************************************************
        MEMORY USED:     7216 WORDS OF 4 BYTES
        ( 0.14  % OF TOTAL MEMORY)
APARTADO E
D =   0.9400
DbN-Z=   -2.400
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =   0.9400

N/(D+Z) =   0.8949
1/Db=   1.429
LA PRODUCTIVIDAD OPTIMA ES =   0.8949
- MEAN VALUE ANALYSIS ("MVA") -
**********************************************************************
*   NAME   *  SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
**********************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.2212   *0.2747   *0.3725E-01* 7.375   *
*      *      *      *      *      *      *
*DISC    *0.1000   *0.6453   * 1.350   *0.2092   * 6.453   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 7.375   * 8.000   *0.9219   *
*      *      *      *      *      *      *
**********************************************************************
        MEMORY USED:     7242 WORDS OF 4 BYTES
        ( 0.14  % OF TOTAL MEMORY)
APARTADO E
D =   0.9400
DbN-Z=   -1.700
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =   0.9400

N/(D+Z) =    1.007
1/Db=   1.429
LA PRODUCTIVIDAD OPTIMA ES =    1.007
- MEAN VALUE ANALYSIS ("MVA") -
**********************************************************************
*   NAME   *  SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
**********************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.2412   *0.3074   *0.3824E-01* 8.039   *
*      *      *      *      *      *      *
*DISC    *0.1000   *0.7034   * 1.653   *0.2350   * 7.034   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 8.039   * 8.000   * 1.005   *
*      *      *      *      *      *      *
**********************************************************************
        MEMORY USED:     7268 WORDS OF 4 BYTES
        ( 0.15  % OF TOTAL MEMORY)
APARTADO E
D =   0.9400
DbN-Z=   -1.000
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =   0.9400

N/(D+Z) =    1.119
```

```
1/Db=   1.429
LA PRODUCTIVIDAD OPTIMA ES =   1.119
- MEAN VALUE ANALYSIS ("MVA") -
*****************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*****************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.2596   *0.3394   *0.3922E-01* 8.652   *
*      *      *      *      *      *      *
*DISC    *0.1000   *0.7570   * 2.009   *0.2653   * 7.570   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 8.652   * 8.000   * 1.081   *
*      *      *      *      *      *      *
*****************************************************************
        MEMORY USED:     7294 WORDS OF 4 BYTES
        ( 0.15  % OF TOTAL MEMORY)
APARTADO E
D =  0.9400
DbN-Z=  -0.3000
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =  0.9400

N/(D+Z) =   1.230
1/Db=   1.429
LA PRODUCTIVIDAD OPTIMA ES =   1.230
- MEAN VALUE ANALYSIS ("MVA") -
*****************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*****************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.2762   *0.3699   *0.4018E-01* 9.206   *
*      *      *      *      *      *      *
*DISC    *0.1000   *0.8056   * 2.424   *0.3009   * 8.056   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 9.206   * 8.000   * 1.151   *
*      *      *      *      *      *      *
*****************************************************************
        MEMORY USED:     7320 WORDS OF 4 BYTES
        ( 0.15  % OF TOTAL MEMORY)
APARTADO E
D =  0.9400
DbN-Z=  0.4000
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =  0.9400

N/(D+Z) =   1.342
1/Db=   1.429
LA PRODUCTIVIDAD OPTIMA ES =   1.342
- MEAN VALUE ANALYSIS ("MVA") -
*****************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*****************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.2909   *0.3985   *0.4110E-01* 9.697   *
*      *      *      *      *      *      *
*DISC    *0.1000   *0.8485   * 2.905   *0.3424   * 8.485   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 9.697   * 8.000   * 1.212   *
```

```
*      *      *      *      *      *      *
*****************************************************************
        MEMORY USED:     7346 WORDS OF 4 BYTES
        ( 0.15  % OF TOTAL MEMORY)
APARTADO E
D =  0.9400
DbN-Z=   1.100
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =   1.100

N/(D+Z) =   1.454
1/Db=   1.429
LA PRODUCTIVIDAD OPTIMA ES =   1.429
- MEAN VALUE ANALYSIS ("MVA") -
*****************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*****************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.3035   *0.4245   *0.4196E-01* 10.12   *
*      *      *      *      *      *      *
*DISC    *0.1000   *0.8854   * 3.457   *0.3905   * 8.854   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 10.12   * 8.000   * 1.265   *
*      *      *      *      *      *      *
*****************************************************************
        MEMORY USED:     7372 WORDS OF 4 BYTES
        ( 0.15  % OF TOTAL MEMORY)
APARTADO E
D =  0.9400
DbN-Z=   1.800
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =   1.800

N/(D+Z) =   1.566
1/Db=   1.429
LA PRODUCTIVIDAD OPTIMA ES =   1.429
- MEAN VALUE ANALYSIS ("MVA") -
*****************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*****************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.3141   *0.4474   *0.4274E-01* 10.47   *
*      *      *      *      *      *      *
*DISC    *0.1000   *0.9161   * 4.083   *0.4457   * 9.161   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 10.47   * 8.000   * 1.309   *
*      *      *      *      *      *      *
*****************************************************************
        MEMORY USED:     7398 WORDS OF 4 BYTES
        ( 0.15  % OF TOTAL MEMORY)
APARTADO E
D =  0.9400
DbN-Z=   2.500
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =   2.500

N/(D+Z) =   1.678
1/Db=   1.429
LA PRODUCTIVIDAD OPTIMA ES =   1.429
```

```
- MEAN VALUE ANALYSIS ("MVA") -
*****************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*****************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.3225   *0.4668   *0.4342E-01* 10.75   *
*      *      *      *      *      *      *
*DISC    *0.1000   *0.9407   * 4.782   *0.5083   * 9.407   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 10.75   * 8.000   * 1.344   *
*      *      *      *      *      *      *
*****************************************************************
        MEMORY USED:     7424 WORDS OF 4 BYTES
        ( 0.15  % OF TOTAL MEMORY)
APARTADO E
D =  0.9400
DbN-Z=   3.200
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =   3.200

N/(D+Z) =   1.790
1/Db=   1.429
LA PRODUCTIVIDAD OPTIMA ES =   1.429
- MEAN VALUE ANALYSIS ("MVA") -
*****************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*****************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.3290   *0.4827   *0.4401E-01* 10.97   *
*      *      *      *      *      *      *
*DISC    *0.1000   *0.9597   * 5.549   *0.5782   * 9.597   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 10.97   * 8.000   * 1.371   *
*      *      *      *      *      *      *
*****************************************************************
        MEMORY USED:     7450 WORDS OF 4 BYTES
        ( 0.15  % OF TOTAL MEMORY)
APARTADO E
D =  0.9400
DbN-Z=   3.900
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =   3.900

N/(D+Z) =   1.902
1/Db=   1.429
LA PRODUCTIVIDAD OPTIMA ES =   1.429
- MEAN VALUE ANALYSIS ("MVA") -
*****************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*****************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.3338   *0.4950   *0.4448E-01* 11.13   *
*      *      *      *      *      *      *
*DISC    *0.1000   *0.9737   * 6.377   *0.6549   * 9.737   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 11.13   * 8.000   * 1.391   *
*      *      *      *      *      *      *
*****************************************************************
```

```
        MEMORY USED:     7476 WORDS OF 4 BYTES
        ( 0.15 % OF TOTAL MEMORY)
APARTADO E
D =  0.9400
DbN-Z=   4.600
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =   4.600

N/(D+Z) =   2.013
1/Db=   1.429
LA PRODUCTIVIDAD OPTIMA ES =   1.429
- MEAN VALUE ANALYSIS ("MVA") -
****************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
****************************************************************
*      *      *      *      *      *      *
*CPU    *0.3000E-01*0.3372   *0.5041   *0.4485E-01* 11.24   *
*      *      *      *      *      *      *
*DISC   *0.1000   *0.9835   * 7.255   *0.7377   * 9.835   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 11.24   * 8.000   * 1.405   *
*      *      *      *      *      *      *
****************************************************************
        MEMORY USED:     7502 WORDS OF 4 BYTES
        ( 0.15 % OF TOTAL MEMORY)
APARTADO E
D =  0.9400
DbN-Z=   5.300
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =   5.300

N/(D+Z) =   2.125
1/Db=   1.429
LA PRODUCTIVIDAD OPTIMA ES =   1.429
- MEAN VALUE ANALYSIS ("MVA") -
****************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
****************************************************************
*      *      *      *      *      *      *
*CPU    *0.3000E-01*0.3395   *0.5106   *0.4512E-01* 11.32   *
*      *      *      *      *      *      *
*DISC   *0.1000   *0.9901   * 8.174   *0.8255   * 9.901   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 11.32   * 8.000   * 1.414   *
*      *      *      *      *      *      *
****************************************************************
        MEMORY USED:     7528 WORDS OF 4 BYTES
        ( 0.15 % OF TOTAL MEMORY)
APARTADO E
D =  0.9400
DbN-Z=   6.000
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =   6.000

N/(D+Z) =   2.237
1/Db=   1.429
LA PRODUCTIVIDAD OPTIMA ES =   1.429
- MEAN VALUE ANALYSIS ("MVA") -
****************************************************************
```

```
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
**********************************************************************
*     *     *     *     *     *     *
*CPU    *0.3000E-01*0.3409  *0.5150  *0.4532E-01* 11.36  *
*     *     *     *     *     *     *
*DISC   *0.1000  *0.9943  * 9.122  *0.9174  * 9.943  *
*     *     *     *     *     *     *
*TERMINAL * 8.000  *0.0000E+00* 11.36  * 8.000  * 1.420  *
*     *     *     *     *     *     *
**********************************************************************
        MEMORY USED:     7554 WORDS OF 4 BYTES
        ( 0.15  % OF TOTAL MEMORY)
APARTADO E
D =  0.9400
DbN-Z=  6.700
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =   6.700

N/(D+Z) =   2.349
1/Db=   1.429
LA PRODUCTIVIDAD OPTIMA ES =   1.429
- MEAN VALUE ANALYSIS ("MVA") -
**********************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
**********************************************************************
*     *     *     *     *     *     *
*CPU    *0.3000E-01*0.3418  *0.5178  *0.4545E-01* 11.39  *
*     *     *     *     *     *     *
*DISC   *0.1000  *0.9968  * 10.09  * 1.012  * 9.968  *
*     *     *     *     *     *     *
*TERMINAL * 8.000  *0.0000E+00* 11.39  * 8.000  * 1.424  *
*     *     *     *     *     *     *
**********************************************************************
        MEMORY USED:     7580 WORDS OF 4 BYTES
        ( 0.15  % OF TOTAL MEMORY)
APARTADO E
D =  0.9400
DbN-Z=  7.400
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =   7.400

N/(D+Z) =   2.461
1/Db=   1.429
LA PRODUCTIVIDAD OPTIMA ES =   1.429
- MEAN VALUE ANALYSIS ("MVA") -
**********************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
**********************************************************************
*     *     *     *     *     *     *
*CPU    *0.3000E-01*0.3423  *0.5195  *0.4553E-01* 11.41  *
*     *     *     *     *     *     *
*DISC   *0.1000  *0.9983  * 11.07  * 1.109  * 9.983  *
*     *     *     *     *     *     *
*TERMINAL * 8.000  *0.0000E+00* 11.41  * 8.000  * 1.426  *
*     *     *     *     *     *     *
**********************************************************************
        MEMORY USED:     7606 WORDS OF 4 BYTES
        ( 0.15  % OF TOTAL MEMORY)
```

```
APARTADO E
D =  0.9400
DbN-Z=  8.100
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =  8.100

N/(D+Z) =  2.573
1/Db=  1.429
LA PRODUCTIVIDAD OPTIMA ES =  1.429
- MEAN VALUE ANALYSIS ("MVA") -
*****************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*****************************************************************
*      *      *      *      *      *      *
*CPU    *0.3000E-01*0.3426  *0.5205  *0.4559E-01* 11.42  *
*      *      *      *      *      *      *
*DISC   *0.1000  *0.9991  * 12.06  * 1.207  * 9.991  *
*      *      *      *      *      *      *
*TERMINAL * 8.000  *0.0000E+00* 11.42  * 8.000  * 1.427  *
*      *      *      *      *      *      *
*****************************************************************
        MEMORY USED:     7632 WORDS OF 4 BYTES
        ( 0.15  % OF TOTAL MEMORY)
APARTADO E
D =  0.9400
DbN-Z=  8.800
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =  8.800

N/(D+Z) =  2.685
1/Db=  1.429
LA PRODUCTIVIDAD OPTIMA ES =  1.429
- MEAN VALUE ANALYSIS ("MVA") -
*****************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*****************************************************************
*      *      *      *      *      *      *
*CPU    *0.3000E-01*0.3427  *0.5211  *0.4562E-01* 11.42  *
*      *      *      *      *      *      *
*DISC   *0.1000  *0.9996  * 13.06  * 1.306  * 9.996  *
*      *      *      *      *      *      *
*TERMINAL * 8.000  *0.0000E+00* 11.42  * 8.000  * 1.428  *
*      *      *      *      *      *      *
*****************************************************************
        MEMORY USED:     7658 WORDS OF 4 BYTES
        ( 0.15  % OF TOTAL MEMORY)
APARTADO E
D =  0.9400
DbN-Z=  9.500
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =  9.500

N/(D+Z) =  2.796
1/Db=  1.429
LA PRODUCTIVIDAD OPTIMA ES =  1.429
- MEAN VALUE ANALYSIS ("MVA") -
*****************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*****************************************************************
```

```
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.3428   *0.5214   *0.4563E-01* 11.43   *
*      *      *      *      *      *      *
*DISC    *0.1000   *0.9998   * 14.05   * 1.406   * 9.998   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 11.43   * 8.000   * 1.428   *
*      *      *      *      *      *      *
**********************************************************************
        MEMORY USED:     7684 WORDS OF 4 BYTES
        ( 0.15 % OF TOTAL MEMORY)
APARTADO E
D =  0.9400
DbN-Z=   10.20
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =   10.20

N/(D+Z) =   2.908
1/Db=   1.429
LA PRODUCTIVIDAD OPTIMA ES =   1.429
- MEAN VALUE ANALYSIS ("MVA") -
**********************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
**********************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.3428   *0.5216   *0.4564E-01* 11.43   *
*      *      *      *      *      *      *
*DISC    *0.1000   *0.9999   * 15.05   * 1.505   * 9.999   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 11.43   * 8.000   * 1.428   *
*      *      *      *      *      *      *
**********************************************************************
        MEMORY USED:     7710 WORDS OF 4 BYTES
        ( 0.15 % OF TOTAL MEMORY)
APARTADO E
D =  0.9400
DbN-Z=   10.90
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =   10.90

N/(D+Z) =   3.020
1/Db=   1.429
LA PRODUCTIVIDAD OPTIMA ES =   1.429
- MEAN VALUE ANALYSIS ("MVA") -
**********************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
**********************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.3428   *0.5217   *0.4565E-01* 11.43   *
*      *      *      *      *      *      *
*DISC    *0.1000   * 1.000   * 16.05   * 1.605   *10.000   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 11.43   * 8.000   * 1.429   *
*      *      *      *      *      *      *
**********************************************************************
        MEMORY USED:     7736 WORDS OF 4 BYTES
        ( 0.15 % OF TOTAL MEMORY)
APARTADO E
D =  0.9400
```

```
DbN-Z=   11.60
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =   11.60

N/(D+Z) =   3.132
1/Db=   1.429
LA PRODUCTIVIDAD OPTIMA ES =   1.429
- MEAN VALUE ANALYSIS ("MVA") -
**********************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
**********************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.3429   *0.5217   *0.4565E-01* 11.43   *
*      *      *      *      *      *      *
*DISC    *0.1000   * 1.000   * 17.05   * 1.705   *10.000   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 11.43   * 8.000   * 1.429   *
*      *      *      *      *      *      *
**********************************************************************
        MEMORY USED:     7762 WORDS OF 4 BYTES
        ( 0.16 % OF TOTAL MEMORY)
APARTADO E
D =  0.9400
DbN-Z=   12.30
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =   12.30

N/(D+Z) =   3.244
1/Db=   1.429
LA PRODUCTIVIDAD OPTIMA ES =   1.429
- MEAN VALUE ANALYSIS ("MVA") -
**********************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
**********************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.3429   *0.5217   *0.4565E-01* 11.43   *
*      *      *      *      *      *      *
*DISC    *0.1000   * 1.000   * 18.05   * 1.805   *10.000   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 11.43   * 8.000   * 1.429   *
*      *      *      *      *      *      *
**********************************************************************
        MEMORY USED:     7788 WORDS OF 4 BYTES
        ( 0.16 % OF TOTAL MEMORY)
APARTADO E
D =  0.9400
DbN-Z=   13.00
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =   13.00

N/(D+Z) =   3.356
1/Db=   1.429
LA PRODUCTIVIDAD OPTIMA ES =   1.429
  38 /END/
```

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apartado f

```
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```
  1 /DECLARE/ QUEUE CPU,DISC(2),TERMINAL;
  2       REAL PROB1(2)=(3.5,3.5);
  3       REAL R, VCPU, DDISC, DCPU, DDISCO2,DEMD1,DEMD2,PROD1,PROD2 ;
  4       INTEGER N1;
  5 /STATION/ NAME=CPU;
  6       SERVICE=EXP(0.03);
  7       TRANSIT=DISC,PROB1,TERMINAL,1;
  8 /STATION/ NAME=DISC;
  9                               TRANSIT = CPU;
 10 /STATION/ NAME = DISC(1);
 11                   SERVICE= EXP(0.1);
 12 /STATION/ NAME = DISC(2);
 13                   SERVICE= EXP(0.1);
 14 /STATION/ NAME=TERMINAL;
 15       TYPE=INFINITE;
 16       INIT=N1;
 17       SERVICE=EXP(8.);
 18       TRANSIT=CPU;
 19 /CONTROL/ CLASS=ALL QUEUE;
 20 /EXEC/   FOR N1:=1 STEP 1 UNTIL 30 DO
 21       BEGIN
 22        SOLVE;
 23                               PRINT("NUMERO DE USUARIOS=",N1);
 24                               R:= (N1/MTHRUPUT(TERMINAL))-MSERVICE(TERMINAL);
 25                               PRINT("TIEMPO DE RESPUESTA DEL SISTEMA (R)= ", R);
 26                               PRINT("PRODUCTIVIDAD DEL SISTEMA (X0) = ", MTHRUPUT(TERMINAL));
 27                               VCPU:=8;
 28        DDISC:= MSERVICE(DISC(1))*PROB1(1);
 29                               DDISCO2:=MSERVICE(DISC(2))*PROB1(2);
 30        DCPU:= VCPU*MSERVICE(CPU);
 31                   DEMD1:= DCPU+DDISC+DDISCO2;
 32                   DEMD2:=(DDISC*N1)-MSERVICE(TERMINAL);
 33                   PRINT("D = ", DEMD1);
 34                   PRINT("DbN-Z= ", DEMD2);
 35                   PRINT("R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} = ", MAX(DEMD1,DEM
D2));
 36                   PRINT("");
 37                   PROD1:=N1/(DEMD1+MSERVICE(TERMINAL));
 38                   PROD2:=1/(PROB1(1)*MSERVICE(DISC(1)));
 39                   PRINT("N/(D+Z) = ", PROD1);
 40                   PRINT("1/Db= ", PROD2);
 41                   PRINT("LA PRODUCTIVIDAD OPTIMA ES = ", MIN(PROD1,PROD2));
 42
 43
 44
 45       END;
 - MEAN VALUE ANALYSIS ("MVA") -
 ***************************************************************
 *  NAME   *  SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
 ***************************************************************
 *      *      *      *      *      *      *
 *CPU     *0.3000E-01*0.2685E-01*0.2685E-01*0.3000E-01*0.8949   *
 *      *      *      *      *      *      *
 *DISC  1 *0.1000   *0.3915E-01*0.3915E-01*0.1000   *0.3915   *
 *      *      *      *      *      *      *
 *DISC  2 *0.1000   *0.3915E-01*0.3915E-01*0.1000   *0.3915   *
```

```
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00*0.8949   * 8.000   *0.1119   *
*      *      *      *      *      *      *
*********************************************************************
        MEMORY USED:      7452 WORDS OF 4 BYTES
        ( 0.15  % OF TOTAL MEMORY)
NUMERO DE USUARIOS=      1
TIEMPO DE RESPUESTA DEL SISTEMA (R)=  0.9400
PRODUCTIVIDAD DEL SISTEMA (X0) =  0.1119
D =  0.9400
DbN-Z=  -7.650
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =  0.9400

N/(D+Z) =  0.1119
1/Db=   2.857
LA PRODUCTIVIDAD OPTIMA ES =  0.1119
- MEAN VALUE ANALYSIS ("MVA") -
*********************************************************************
*  NAME  *  SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*********************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.5349E-01*0.5492E-01*0.3081E-01* 1.783   *
*      *      *      *      *      *      *
*DISC  1 *0.1000   *0.7800E-01*0.8106E-01*0.1039   *0.7800   *
*      *      *      *      *      *      *
*DISC  2 *0.1000   *0.7800E-01*0.8106E-01*0.1039   *0.7800   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 1.783   * 8.000   *0.2229   *
*      *      *      *      *      *      *
*********************************************************************
        MEMORY USED:      7475 WORDS OF 4 BYTES
        ( 0.15  % OF TOTAL MEMORY)
NUMERO DE USUARIOS=      2
TIEMPO DE RESPUESTA DEL SISTEMA (R)=  0.9738
PRODUCTIVIDAD DEL SISTEMA (X0) =  0.2229
D =  0.9400
DbN-Z=  -7.300
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =  0.9400

N/(D+Z) =  0.2237
1/Db=   2.857
LA PRODUCTIVIDAD OPTIMA ES =  0.2237
- MEAN VALUE ANALYSIS ("MVA") -
*********************************************************************
*  NAME  *  SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*********************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.7991E-01*0.8430E-01*0.3165E-01* 2.664   *
*      *      *      *      *      *      *
*DISC  1 *0.1000   *0.1165   *0.1260   *0.1081   * 1.165   *
*      *      *      *      *      *      *
*DISC  2 *0.1000   *0.1165   *0.1260   *0.1081   * 1.165   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 2.664   * 8.000   *0.3330   *
*      *      *      *      *      *      *
*********************************************************************
```

```
        MEMORY USED:     7498 WORDS OF 4 BYTES
        ( 0.15 % OF TOTAL MEMORY)
NUMERO DE USUARIOS=      3
TIEMPO DE RESPUESTA DEL SISTEMA (R)=   1.010
PRODUCTIVIDAD DEL SISTEMA (X0) =  0.3330
D =  0.9400
DbN-Z=  -6.950
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =  0.9400

N/(D+Z) =  0.3356
1/Db=   2.857
LA PRODUCTIVIDAD OPTIMA ES =  0.3356
- MEAN VALUE ANALYSIS ("MVA") -
*****************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*****************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.1061   *0.1150   *0.3253E-01* 3.537   *
*      *      *      *      *      *      *
*DISC  1 *0.1000   *0.1547   *0.1742   *0.1126   * 1.547   *
*      *      *      *      *      *      *
*DISC  2 *0.1000   *0.1547   *0.1742   *0.1126   * 1.547   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 3.537   * 8.000   *0.4421   *
*      *      *      *      *      *      *
*****************************************************************
        MEMORY USED:     7521 WORDS OF 4 BYTES
        ( 0.15 % OF TOTAL MEMORY)
NUMERO DE USUARIOS=      4
TIEMPO DE RESPUESTA DEL SISTEMA (R)=   1.048
PRODUCTIVIDAD DEL SISTEMA (X0) =  0.4421
D =  0.9400
DbN-Z=  -6.600
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =  0.9400

N/(D+Z) =  0.4474
1/Db=   2.857
LA PRODUCTIVIDAD OPTIMA ES =  0.4474
- MEAN VALUE ANALYSIS ("MVA") -
*****************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*****************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.1320   *0.1472   *0.3345E-01* 4.401   *
*      *      *      *      *      *      *
*DISC  1 *0.1000   *0.1925   *0.2261   *0.1174   * 1.925   *
*      *      *      *      *      *      *
*DISC  2 *0.1000   *0.1925   *0.2261   *0.1174   * 1.925   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 4.401   * 8.000   *0.5501   *
*      *      *      *      *      *      *
*****************************************************************
        MEMORY USED:     7544 WORDS OF 4 BYTES
        ( 0.15 % OF TOTAL MEMORY)
NUMERO DE USUARIOS=      5
TIEMPO DE RESPUESTA DEL SISTEMA (R)=   1.090
```

```
PRODUCTIVIDAD DEL SISTEMA (X0) =  0.5501
D =  0.9400
DbN-Z=  -6.250
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =  0.9400

N/(D+Z) =  0.5593
1/Db=   2.857
LA PRODUCTIVIDAD OPTIMA ES =  0.5593
- MEAN VALUE ANALYSIS ("MVA") -
*****************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*****************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.1577   *0.1809   *0.3442E-01* 5.255   *
*      *      *      *      *      *      *
*DISC  1 *0.1000   *0.2299   *0.2819   *0.1226   * 2.299   *
*      *      *      *      *      *      *
*DISC  2 *0.1000   *0.2299   *0.2819   *0.1226   * 2.299   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 5.255   * 8.000   *0.6569   *
*      *      *      *      *      *      *
*****************************************************************
        MEMORY USED:     7567 WORDS OF 4 BYTES
        ( 0.15  % OF TOTAL MEMORY)
NUMERO DE USUARIOS=      6
TIEMPO DE RESPUESTA DEL SISTEMA (R)=   1.134
PRODUCTIVIDAD DEL SISTEMA (X0) =  0.6569
D =  0.9400
DbN-Z=  -5.900
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =  0.9400

N/(D+Z) =  0.6711
1/Db=   2.857
LA PRODUCTIVIDAD OPTIMA ES =  0.6711
- MEAN VALUE ANALYSIS ("MVA") -
*****************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*****************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.1830   *0.2161   *0.3543E-01* 6.100   *
*      *      *      *      *      *      *
*DISC  1 *0.1000   *0.2669   *0.3421   *0.1282   * 2.669   *
*      *      *      *      *      *      *
*DISC  2 *0.1000   *0.2669   *0.3421   *0.1282   * 2.669   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 6.100   * 8.000   *0.7625   *
*      *      *      *      *      *      *
*****************************************************************
        MEMORY USED:     7590 WORDS OF 4 BYTES
        ( 0.15  % OF TOTAL MEMORY)
NUMERO DE USUARIOS=      7
TIEMPO DE RESPUESTA DEL SISTEMA (R)=   1.181
PRODUCTIVIDAD DEL SISTEMA (X0) =  0.7625
D =  0.9400
DbN-Z=  -5.550
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =  0.9400
```

N/(D+Z) = 0.7830
1/Db= 2.857
LA PRODUCTIVIDAD OPTIMA ES = 0.7830
- MEAN VALUE ANALYSIS ("MVA") -

NAME	SERVICE	BUSY PCT	CUST NB	RESPONSE	THRUPUT
CPU	0.3000E-01	0.2080	0.2529	0.3648E-01	6.933
DISC 1	0.1000	0.3033	0.4071	0.1342	3.033
DISC 2	0.1000	0.3033	0.4071	0.1342	3.033
TERMINAL	8.000	0.0000E+00	6.933	8.000	0.8666

MEMORY USED: 7613 WORDS OF 4 BYTES
(0.15 % OF TOTAL MEMORY)
NUMERO DE USUARIOS= 8
TIEMPO DE RESPUESTA DEL SISTEMA (R)= 1.231
PRODUCTIVIDAD DEL SISTEMA (X0) = 0.8666
D = 0.9400
DbN-Z= -5.200
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} = 0.9400

N/(D+Z) = 0.8949
1/Db= 2.857
LA PRODUCTIVIDAD OPTIMA ES = 0.8949
- MEAN VALUE ANALYSIS ("MVA") -

NAME	SERVICE	BUSY PCT	CUST NB	RESPONSE	THRUPUT
CPU	0.3000E-01	0.2326	0.2915	0.3759E-01	7.754
DISC 1	0.1000	0.3392	0.4773	0.1407	3.392
DISC 2	0.1000	0.3392	0.4773	0.1407	3.392
TERMINAL	8.000	0.0000E+00	7.754	8.000	0.9692

MEMORY USED: 7636 WORDS OF 4 BYTES
(0.15 % OF TOTAL MEMORY)
NUMERO DE USUARIOS= 9
TIEMPO DE RESPUESTA DEL SISTEMA (R)= 1.286
PRODUCTIVIDAD DEL SISTEMA (X0) = 0.9692
D = 0.9400
DbN-Z= -4.850
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} = 0.9400

N/(D+Z) = 1.007
1/Db= 2.857
LA PRODUCTIVIDAD OPTIMA ES = 1.007

```
- MEAN VALUE ANALYSIS ("MVA") -
*****************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*****************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.2568   *0.3317   *0.3874E-01* 8.562   *
*      *      *      *      *      *      *
*DISC  1 *0.1000   *0.3746   *0.5534   *0.1477   * 3.746   *
*      *      *      *      *      *      *
*DISC  2 *0.1000   *0.3746   *0.5534   *0.1477   * 3.746   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 8.562   * 8.000   * 1.070   *
*      *      *      *      *      *      *
*****************************************************************
        MEMORY USED:     7659 WORDS OF 4 BYTES
        ( 0.15  % OF TOTAL MEMORY)
NUMERO DE USUARIOS=     10
TIEMPO DE RESPUESTA DEL SISTEMA (R)=   1.344
PRODUCTIVIDAD DEL SISTEMA (X0) =   1.070
D =  0.9400
DbN-Z=  -4.500
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =  0.9400

N/(D+Z) =   1.119
1/Db=   2.857
LA PRODUCTIVIDAD OPTIMA ES =   1.119
- MEAN VALUE ANALYSIS ("MVA") -
*****************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*****************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.2806   *0.3737   *0.3995E-01* 9.355   *
*      *      *      *      *      *      *
*DISC  1 *0.1000   *0.4093   *0.6357   *0.1553   * 4.093   *
*      *      *      *      *      *      *
*DISC  2 *0.1000   *0.4093   *0.6357   *0.1553   * 4.093   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 9.355   * 8.000   * 1.169   *
*      *      *      *      *      *      *
*****************************************************************
        MEMORY USED:     7682 WORDS OF 4 BYTES
        ( 0.15  % OF TOTAL MEMORY)
NUMERO DE USUARIOS=     11
TIEMPO DE RESPUESTA DEL SISTEMA (R)=   1.407
PRODUCTIVIDAD DEL SISTEMA (X0) =   1.169
D =  0.9400
DbN-Z=  -4.150
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =  0.9400

N/(D+Z) =   1.230
1/Db=   2.857
LA PRODUCTIVIDAD OPTIMA ES =   1.230
- MEAN VALUE ANALYSIS ("MVA") -
*****************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*****************************************************************
```

```
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.3040   *0.4176   *0.4121E-01* 10.13   *
*      *      *      *      *      *      *
*DISC  1 *0.1000   *0.4433   *0.7251   *0.1636   * 4.433   *
*      *      *      *      *      *      *
*DISC  2 *0.1000   *0.4433   *0.7251   *0.1636   * 4.433   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 10.13   * 8.000   * 1.267   *
*      *      *      *      *      *      *
**********************************************************************
         MEMORY USED:      7705 WORDS OF 4 BYTES
         ( 0.15  % OF TOTAL MEMORY)
NUMERO DE USUARIOS=      12
TIEMPO DE RESPUESTA DEL SISTEMA (R)=   1.475
PRODUCTIVIDAD DEL SISTEMA (X0) =   1.267
D =  0.9400
DbN-Z=  -3.800
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =  0.9400

N/(D+Z) =   1.342
1/Db=   2.857
LA PRODUCTIVIDAD OPTIMA ES =   1.342
- MEAN VALUE ANALYSIS ("MVA") -
**********************************************************************
*   NAME   *  SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
**********************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.3268   *0.4632   *0.4253E-01* 10.89   *
*      *      *      *      *      *      *
*DISC  1 *0.1000   *0.4766   *0.8221   *0.1725   * 4.766   *
*      *      *      *      *      *      *
*DISC  2 *0.1000   *0.4766   *0.8221   *0.1725   * 4.766   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 10.89   * 8.000   * 1.362   *
*      *      *      *      *      *      *
**********************************************************************
         MEMORY USED:      7728 WORDS OF 4 BYTES
         ( 0.15  % OF TOTAL MEMORY)
NUMERO DE USUARIOS=      13
TIEMPO DE RESPUESTA DEL SISTEMA (R)=   1.548
PRODUCTIVIDAD DEL SISTEMA (X0) =   1.362
D =  0.9400
DbN-Z=  -3.450
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =  0.9400

N/(D+Z) =   1.454
1/Db=   2.857
LA PRODUCTIVIDAD OPTIMA ES =   1.454
- MEAN VALUE ANALYSIS ("MVA") -
**********************************************************************
*   NAME   *  SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
**********************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.3490   *0.5107   *0.4390E-01* 11.63   *
*      *      *      *      *      *      *
*DISC  1 *0.1000   *0.5090   *0.9275   *0.1822   * 5.090   *
```

```
*      *      *      *      *      *      *
*DISC  2 *0.1000   *0.5090   *0.9275   *0.1822   * 5.090   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 11.63   * 8.000   * 1.454   *
*      *      *      *      *      *      *
*********************************************************************
        MEMORY USED:     7751 WORDS OF 4 BYTES
        ( 0.16 % OF TOTAL MEMORY)
NUMERO DE USUARIOS=     14
TIEMPO DE RESPUESTA DEL SISTEMA (R)=   1.627
PRODUCTIVIDAD DEL SISTEMA (X0) =   1.454
D =  0.9400
DbN-Z=  -3.100
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =  0.9400

N/(D+Z) =   1.566
1/Db=   2.857
LA PRODUCTIVIDAD OPTIMA ES =   1.566
- MEAN VALUE ANALYSIS ("MVA") -
*********************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*********************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.3707   *0.5600   *0.4532E-01* 12.36   *
*      *      *      *      *      *      *
*DISC  1 *0.1000   *0.5406   * 1.042   *0.1927   * 5.406   *
*      *      *      *      *      *      *
*DISC  2 *0.1000   *0.5406   * 1.042   *0.1927   * 5.406   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 12.36   * 8.000   * 1.545   *
*      *      *      *      *      *      *
*********************************************************************
        MEMORY USED:     7774 WORDS OF 4 BYTES
        ( 0.16 % OF TOTAL MEMORY)
NUMERO DE USUARIOS=     15
TIEMPO DE RESPUESTA DEL SISTEMA (R)=   1.712
PRODUCTIVIDAD DEL SISTEMA (X0) =   1.545
D =  0.9400
DbN-Z=  -2.750
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =  0.9400

N/(D+Z) =   1.678
1/Db=   2.857
LA PRODUCTIVIDAD OPTIMA ES =   1.678
- MEAN VALUE ANALYSIS ("MVA") -
*********************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*********************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.3917   *0.6110   *0.4680E-01* 13.06   *
*      *      *      *      *      *      *
*DISC  1 *0.1000   *0.5712   * 1.166   *0.2042   * 5.712   *
*      *      *      *      *      *      *
*DISC  2 *0.1000   *0.5712   * 1.166   *0.2042   * 5.712   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 13.06   * 8.000   * 1.632   *
```

```
*      *      *      *      *      *      *
*****************************************************************
        MEMORY USED:     7797 WORDS OF 4 BYTES
        ( 0.16 % OF TOTAL MEMORY)
NUMERO DE USUARIOS=     16
TIEMPO DE RESPUESTA DEL SISTEMA (R)=   1.804
PRODUCTIVIDAD DEL SISTEMA (X0) =   1.632
D =  0.9400
DbN-Z=  -2.400
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =  0.9400

N/(D+Z) =   1.790
1/Db=   2.857
LA PRODUCTIVIDAD OPTIMA ES =   1.790
- MEAN VALUE ANALYSIS ("MVA") -
*****************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*****************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.4120   *0.6637   *0.4833E-01* 13.73   *
*      *      *      *      *      *      *
*DISC  1 *0.1000   *0.6008   * 1.302   *0.2166   * 6.008   *
*      *      *      *      *      *      *
*DISC  2 *0.1000   *0.6008   * 1.302   *0.2166   * 6.008   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 13.73   * 8.000   * 1.717   *
*      *      *      *      *      *      *
*****************************************************************
        MEMORY USED:     7820 WORDS OF 4 BYTES
        ( 0.16 % OF TOTAL MEMORY)
NUMERO DE USUARIOS=     17
TIEMPO DE RESPUESTA DEL SISTEMA (R)=   1.903
PRODUCTIVIDAD DEL SISTEMA (X0) =   1.717
D =  0.9400
DbN-Z=  -2.050
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =  0.9400

N/(D+Z) =   1.902
1/Db=   2.857
LA PRODUCTIVIDAD OPTIMA ES =   1.902
- MEAN VALUE ANALYSIS ("MVA") -
*****************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*****************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.4316   *0.7180   *0.4991E-01* 14.39   *
*      *      *      *      *      *      *
*DISC  1 *0.1000   *0.6293   * 1.449   *0.2302   * 6.293   *
*      *      *      *      *      *      *
*DISC  2 *0.1000   *0.6293   * 1.449   *0.2302   * 6.293   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 14.39   * 8.000   * 1.798   *
*      *      *      *      *      *      *
*****************************************************************
        MEMORY USED:     7843 WORDS OF 4 BYTES
        ( 0.16 % OF TOTAL MEMORY)
```

NUMERO DE USUARIOS= 18
TIEMPO DE RESPUESTA DEL SISTEMA (R)= 2.010
PRODUCTIVIDAD DEL SISTEMA (X0) = 1.798
D = 0.9400
DbN-Z= -1.700
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} = 0.9400

N/(D+Z) = 2.013
1/Db= 2.857
LA PRODUCTIVIDAD OPTIMA ES = 2.013
- MEAN VALUE ANALYSIS ("MVA") -
****
* NAME * SERVICE * BUSY PCT * CUST NB * RESPONSE * THRUPUT *
****
* * * * * * *
*CPU *0.3000E-01*0.4503 *0.7736 *0.5154E-01* 15.01 *
* * * * * * *
*DISC 1 *0.1000 *0.6567 * 1.608 *0.2449 * 6.567 *
* * * * * * *
*DISC 2 *0.1000 *0.6567 * 1.608 *0.2449 * 6.567 *
* * * * * * *
*TERMINAL * 8.000 *0.0000E+00* 15.01 * 8.000 * 1.876 *
* * * * * * *
****
  MEMORY USED: 7866 WORDS OF 4 BYTES
  (0.16 % OF TOTAL MEMORY)
NUMERO DE USUARIOS= 19
TIEMPO DE RESPUESTA DEL SISTEMA (R)= 2.126
PRODUCTIVIDAD DEL SISTEMA (X0) = 1.876
D = 0.9400
DbN-Z= -1.350
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} = 0.9400

N/(D+Z) = 2.125
1/Db= 2.857
LA PRODUCTIVIDAD OPTIMA ES = 2.125
- MEAN VALUE ANALYSIS ("MVA") -
****
* NAME * SERVICE * BUSY PCT * CUST NB * RESPONSE * THRUPUT *
****
* * * * * * *
*CPU *0.3000E-01*0.4682 *0.8305 *0.5321E-01* 15.61 *
* * * * * * *
*DISC 1 *0.1000 *0.6828 * 1.781 *0.2608 * 6.828 *
* * * * * * *
*DISC 2 *0.1000 *0.6828 * 1.781 *0.2608 * 6.828 *
* * * * * * *
*TERMINAL * 8.000 *0.0000E+00* 15.61 * 8.000 * 1.951 *
* * * * * * *
****
  MEMORY USED: 7889 WORDS OF 4 BYTES
  (0.16 % OF TOTAL MEMORY)
NUMERO DE USUARIOS= 20
TIEMPO DE RESPUESTA DEL SISTEMA (R)= 2.251
PRODUCTIVIDAD DEL SISTEMA (X0) = 1.951
D = 0.9400

```
DbN-Z=  -1.000
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =  0.9400

N/(D+Z) =  2.237
1/Db=  2.857
LA PRODUCTIVIDAD OPTIMA ES =  2.237
- MEAN VALUE ANALYSIS ("MVA") -
*****************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*****************************************************************
*     *     *     *     *     *     *
*CPU    *0.3000E-01*0.4853  *0.8883  *0.5491E-01* 16.18  *
*     *     *     *     *     *     *
*DISC  1 *0.1000  *0.7077  * 1.968  *0.2781  * 7.077  *
*     *     *     *     *     *     *
*DISC  2 *0.1000  *0.7077  * 1.968  *0.2781  * 7.077  *
*     *     *     *     *     *     *
*TERMINAL  * 8.000  *0.0000E+00* 16.18  * 8.000  * 2.022  *
*     *     *     *     *     *     *
*****************************************************************
        MEMORY USED:     7912 WORDS OF 4 BYTES
        ( 0.16 % OF TOTAL MEMORY)
NUMERO DE USUARIOS=     21
TIEMPO DE RESPUESTA DEL SISTEMA (R)=  2.386
PRODUCTIVIDAD DEL SISTEMA (X0) =  2.022
D =  0.9400
DbN-Z=  -0.6500
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =  0.9400

N/(D+Z) =  2.349
1/Db=  2.857
LA PRODUCTIVIDAD OPTIMA ES =  2.349
- MEAN VALUE ANALYSIS ("MVA") -
*****************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*****************************************************************
*     *     *     *     *     *     *
*CPU    *0.3000E-01*0.5014  *0.9468  *0.5665E-01* 16.71  *
*     *     *     *     *     *     *
*DISC  1 *0.1000  *0.7312  * 2.170  *0.2968  * 7.312  *
*     *     *     *     *     *     *
*DISC  2 *0.1000  *0.7312  * 2.170  *0.2968  * 7.312  *
*     *     *     *     *     *     *
*TERMINAL  * 8.000  *0.0000E+00* 16.71  * 8.000  * 2.089  *
*     *     *     *     *     *     *
*****************************************************************
        MEMORY USED:     7935 WORDS OF 4 BYTES
        ( 0.16 % OF TOTAL MEMORY)
NUMERO DE USUARIOS=     22
TIEMPO DE RESPUESTA DEL SISTEMA (R)=  2.531
PRODUCTIVIDAD DEL SISTEMA (X0) =  2.089
D =  0.9400
DbN-Z=  -0.3000
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =  0.9400

N/(D+Z) =  2.461
```

1/Db= 2.857
LA PRODUCTIVIDAD OPTIMA ES = 2.461
- MEAN VALUE ANALYSIS ("MVA") -
****
* NAME * SERVICE * BUSY PCT * CUST NB * RESPONSE * THRUPUT *
****
* * * * * * *
*CPU *0.3000E-01*0.5165 * 1.006 *0.5840E-01* 17.22 *
* * * * * * *
*DISC 1 *0.1000 *0.7533 * 2.388 *0.3170 * 7.533 *
* * * * * * *
*DISC 2 *0.1000 *0.7533 * 2.388 *0.3170 * 7.533 *
* * * * * * *
*TERMINAL * 8.000 *0.0000E+00* 17.22 * 8.000 * 2.152 *
* * * * * * *
****
MEMORY USED: 7958 WORDS OF 4 BYTES
(0.16 % OF TOTAL MEMORY)
NUMERO DE USUARIOS= 23
TIEMPO DE RESPUESTA DEL SISTEMA (R)= 2.686
PRODUCTIVIDAD DEL SISTEMA (X0) = 2.152
D = 0.9400
DbN-Z= 0.5000E-01
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} = 0.9400

N/(D+Z) = 2.573
1/Db= 2.857
LA PRODUCTIVIDAD OPTIMA ES = 2.573
- MEAN VALUE ANALYSIS ("MVA") -
****
* NAME * SERVICE * BUSY PCT * CUST NB * RESPONSE * THRUPUT *
****
* * * * * * *
*CPU *0.3000E-01*0.5307 * 1.064 *0.6017E-01* 17.69 *
* * * * * * *
*DISC 1 *0.1000 *0.7740 * 2.622 *0.3388 * 7.740 *
* * * * * * *
*DISC 2 *0.1000 *0.7740 * 2.622 *0.3388 * 7.740 *
* * * * * * *
*TERMINAL * 8.000 *0.0000E+00* 17.69 * 8.000 * 2.211 *
* * * * * * *
****
MEMORY USED: 7981 WORDS OF 4 BYTES
(0.16 % OF TOTAL MEMORY)
NUMERO DE USUARIOS= 24
TIEMPO DE RESPUESTA DEL SISTEMA (R)= 2.853
PRODUCTIVIDAD DEL SISTEMA (X0) = 2.211
D = 0.9400
DbN-Z= 0.4000
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} = 0.9400

N/(D+Z) = 2.685
1/Db= 2.857
LA PRODUCTIVIDAD OPTIMA ES = 2.685
- MEAN VALUE ANALYSIS ("MVA") -
****

```
*  NAME  *  SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*****************************************************************
*     *     *     *     *     *     *
*CPU    *0.3000E-01*0.5439   * 1.123   *0.6193E-01* 18.13   *
*     *     *     *     *     *     *
*DISC  1 *0.1000   *0.7932   * 2.873   *0.3622   * 7.932   *
*     *     *     *     *     *     *
*DISC  2 *0.1000   *0.7932   * 2.873   *0.3622   * 7.932   *
*     *     *     *     *     *     *
*TERMINAL  * 8.000   *0.0000E+00* 18.13   * 8.000   * 2.266   *
*     *     *     *     *     *     *
*****************************************************************
        MEMORY USED:     8004 WORDS OF 4 BYTES
        ( 0.16 % OF TOTAL MEMORY)
NUMERO DE USUARIOS=     25
TIEMPO DE RESPUESTA DEL SISTEMA (R)=   3.031
PRODUCTIVIDAD DEL SISTEMA (X0) =   2.266
D =  0.9400
DbN-Z=  0.7500
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =  0.9400

N/(D+Z) =   2.796
1/Db=   2.857
LA PRODUCTIVIDAD OPTIMA ES =   2.796
- MEAN VALUE ANALYSIS ("MVA") -
*****************************************************************
*  NAME  *  SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*****************************************************************
*     *     *     *     *     *     *
*CPU    *0.3000E-01*0.5561   * 1.181   *0.6369E-01* 18.54   *
*     *     *     *     *     *     *
*DISC  1 *0.1000   *0.8110   * 3.141   *0.3873   * 8.110   *
*     *     *     *     *     *     *
*DISC  2 *0.1000   *0.8110   * 3.141   *0.3873   * 8.110   *
*     *     *     *     *     *     *
*TERMINAL  * 8.000   *0.0000E+00* 18.54   * 8.000   * 2.317   *
*     *     *     *     *     *     *
*****************************************************************
        MEMORY USED:     8027 WORDS OF 4 BYTES
        ( 0.16 % OF TOTAL MEMORY)
NUMERO DE USUARIOS=     26
TIEMPO DE RESPUESTA DEL SISTEMA (R)=   3.221
PRODUCTIVIDAD DEL SISTEMA (X0) =   2.317
D =  0.9400
DbN-Z=   1.100
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =   1.100

N/(D+Z) =   2.908
1/Db=   2.857
LA PRODUCTIVIDAD OPTIMA ES =   2.857
- MEAN VALUE ANALYSIS ("MVA") -
*****************************************************************
*  NAME  *  SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*****************************************************************
*     *     *     *     *     *     *
*CPU    *0.3000E-01*0.5673   * 1.237   *0.6542E-01* 18.91   *
```

```
*      *      *      *      *      *      *
*DISC  1 *0.1000   *0.8273   * 3.426   *0.4141   * 8.273   *
*      *      *      *      *      *      *
*DISC  2 *0.1000   *0.8273   * 3.426   *0.4141   * 8.273   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 18.91   * 8.000   * 2.364   *
*      *      *      *      *      *      *
**********************************************************************
        MEMORY USED:     8050 WORDS OF 4 BYTES
        ( 0.16 % OF TOTAL MEMORY)
NUMERO DE USUARIOS=     27
TIEMPO DE RESPUESTA DEL SISTEMA (R)=   3.422
PRODUCTIVIDAD DEL SISTEMA (X0) =   2.364
D =  0.9400
DbN-Z=   1.450
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =   1.450

N/(D+Z) =   3.020
1/Db=   2.857
LA PRODUCTIVIDAD OPTIMA ES =   2.857
- MEAN VALUE ANALYSIS ("MVA") -
**********************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
**********************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.5776   * 1.292   *0.6711E-01* 19.25   *
*      *      *      *      *      *      *
*DISC  1 *0.1000   *0.8423   * 3.728   *0.4426   * 8.423   *
*      *      *      *      *      *      *
*DISC  2 *0.1000   *0.8423   * 3.728   *0.4426   * 8.423   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 19.25   * 8.000   * 2.406   *
*      *      *      *      *      *      *
**********************************************************************
        MEMORY USED:     8073 WORDS OF 4 BYTES
        ( 0.16 % OF TOTAL MEMORY)
NUMERO DE USUARIOS=     28
TIEMPO DE RESPUESTA DEL SISTEMA (R)=   3.635
PRODUCTIVIDAD DEL SISTEMA (X0) =   2.406
D =  0.9400
DbN-Z=   1.800
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =   1.800

N/(D+Z) =   3.132
1/Db=   2.857
LA PRODUCTIVIDAD OPTIMA ES =   2.857
- MEAN VALUE ANALYSIS ("MVA") -
**********************************************************************
*  NAME  * SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
**********************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.5869   * 1.345   *0.6876E-01* 19.56   *
*      *      *      *      *      *      *
*DISC  1 *0.1000   *0.8558   * 4.046   *0.4728   * 8.558   *
*      *      *      *      *      *      *
*DISC  2 *0.1000   *0.8558   * 4.046   *0.4728   * 8.558   *
```

```
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 19.56   * 8.000   * 2.445   *
*      *      *      *      *      *      *
*********************************************************************
        MEMORY USED:     8096 WORDS OF 4 BYTES
        ( 0.16  % OF TOTAL MEMORY)
NUMERO DE USUARIOS=     29
TIEMPO DE RESPUESTA DEL SISTEMA (R)=   3.860
PRODUCTIVIDAD DEL SISTEMA (X0) =   2.445
D =  0.9400
DbN-Z=   2.150
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =   2.150

N/(D+Z) =   3.244
1/Db=   2.857
LA PRODUCTIVIDAD OPTIMA ES =   2.857
- MEAN VALUE ANALYSIS ("MVA") -
*********************************************************************
*  NAME  *  SERVICE * BUSY PCT *  CUST NB * RESPONSE *  THRUPUT *
*********************************************************************
*      *      *      *      *      *      *
*CPU     *0.3000E-01*0.5953   * 1.396   *0.7035E-01* 19.84   *
*      *      *      *      *      *      *
*DISC  1 *0.1000   *0.8681   * 4.381   *0.5046   * 8.681   *
*      *      *      *      *      *      *
*DISC  2 *0.1000   *0.8681   * 4.381   *0.5046   * 8.681   *
*      *      *      *      *      *      *
*TERMINAL  * 8.000   *0.0000E+00* 19.84   * 8.000   * 2.480   *
*      *      *      *      *      *      *
*********************************************************************
        MEMORY USED:     8119 WORDS OF 4 BYTES
        ( 0.16  % OF TOTAL MEMORY)
NUMERO DE USUARIOS=     30
TIEMPO DE RESPUESTA DEL SISTEMA (R)=   4.095
PRODUCTIVIDAD DEL SISTEMA (X0) =   2.480
D =  0.9400
DbN-Z=   2.500
R OPTIMISTA ES EL MAXIMO DE {D, DBN-Z} =   2.500

N/(D+Z) =   3.356
1/Db=   2.857
LA PRODUCTIVIDAD OPTIMA ES =   2.857
  46 /END/
```