10-02 Solution

Program Length

This solution is best viewed on the screen or printed on a color printer. The original program is listed below with red color indicating blocks, words or characters that can be eliminated without damaging the integrity or safety of the original program. Note that some repetitions have been left alone (shown in the final version) - they are marked in blue and can be also eliminated, but only as the last resort.

```
(BASIC TEST.NC)
(FANUC CNC SYSTEM)

(MATERIAL IS 1020 STEEL CUT ON A LASER MACHINE)
(STOCK APPROXIMATELY 1-1.5 MM ALL AROUND)
(X0Y0 AT THE LOWER LEFT CORNER)
(Z0 AT TOP OF PART)

(T01 - 16 DIA CARBIDE CENTER CUTTING END MILL)
(T02 - 12 DIA CARBIDE CENTER END MILL)
(T03 - 10 DIA SPOT DRILL)
(T04 - 4.2 DIA TAP DRILL)
(T05 - M5 X 0.8 TAP)

(T01 - 16 DIA CARBIDE CENTER CUTTING END MILL)
N1 G21
N2 G17 G40 G80 T01
N3 M06
N4 G90 G54 G00 X50.0 Y42.0 S1400 M03 T02
N5 G43 Z25.0 H01 M08
N6 G01 Z2.5 F500.0
N7 Z-4.0 F100.0
N8 G41 X42.0 Y38.0 D01 F150.0
N9 G03 X50.0 Y30.0 I8.0 J0
N10 J12.0
N11 X58.0 Y38.0 I0 J8.0
N12 G01 G40 X50.0 Y42.0
N13 G00 Z2.5 M09
N14 G28 Z2.5 M05
N15 M01

(T02 - 12 DIA CARBIDE CENTER END MILL)
N16 T02
N17 M06
N18 G90 G54 G00 X-10.0 Y-10.0 S1850 M03 T03
N19 G43 Z25.0 H02 M08
N20 G01 Z-12.0 F500.0
N21 G41 X0 Y-3.0 D02 F250.0
N22 Y52.0 F200.0
N23 X29.856 Y60.0
N24 X50.0
N25 G02 Y24.0 I0 J-18.0
N26 G01 X32.0
N27 G03 X25.0 Y17.0 I0 J-7.0
N28 G01 Y3.0
N29 G02 X22.0 Y0 I-3.0 J0
N30 G01 X-3.0
N31 G00 G40 X-10.0 Y-10.0
N32 Z2.5 M09
N33 G28 Z2.5 M05
N34 M01
```

```
(T03 - 10 DIA SPOT DRILL)
N35 T03
N36 M06
N37 G90 G54 G00 X10.0 Y10.0 S1200 M03 T04
N38 G43 Z25.0 H03 M08
N39 G99 G82 R2.0 Z-2.8 P200 F125.0
N40 G91 Y8.0 L4
N41 G90 G80 Z25.0 M09
N42 G28 Z25.0 M05
N43 M01

(T04 - 4.2 DIA TAP DRILL)
N44 T04
N45 M06
N46 G90 G54 G00 X10.0 Y42.0 S1350 M03 T05
N47 G43 Z25.0 H04 M08
N48 G99 G81 R2.0 Z-12.76 F150.0
N49 G91 Y-8.0 L4
N50 G90 G80 Z25.0 M09
N51 G28 Z25.0 M05
N52 M01

(T05 - M5 X 0.8 TAP)
N53 T03
N54 M06
N55 G90 G54 G00 X10.0 Y10.0 S800 M03 T01
N56 G43 Z25.0 H05 M08
N57 G99 G84 R5.0 Z-12.0 F640.0
N58 G91 Y8.0 L4
N59 G90 G80 Z25.0 M09
N60 G28 Z25.0 M05
N61 G28 X10.0 Y42.0
N62 M30
%
```

The final version of the program is shown below. It is not a 'pretty' program, it is much more difficult to interpret, but it did serve its purpose:

```
G21
G17 G40 G80 T1
M6
G90 G54 G0 X50. Y42. S1400 M3 T2
G43 Z25. H1 M8
G1 Z2.5 F500.
Z-4. F100.
G41 X42. Y38. D1 F150.
G3 X50. Y30. I8.
J12.
X58. Y38. J8.
G1 G40 X50. Y42.
G0 Z2.5 M9
G28 Z2.5 M5
M1
T2
M6
G90 G54 G0 X-10. Y-10. S1850 M3 T3
G43 Z25. H2 M8
G1 Z-12. F500.
G41 X0 Y-3. D2 F250.
Y52. F200.
X29.856 Y60.
X50.
G2 Y24. J-18.
G1 X32.
G3 X25. Y17. J-7.
G1 Y3.
G2 X22. Y0 I-3.
G1 X-3.
```

```
G0 G40 X-10. Y-10.
Z2.5 M9
G28 Z2.5 M5
M1
T3
M6
G90 G54 G0 X10. Y10. S1200 M3 T4
G43 Z25. H3 M8
G99 G82 R2. Z-2.8 P200 F125.
G91 Y8. L4
G90 G80 Z25. M9
G28 Z25. M5
M1
T4
M6
G90 G54 G0 X10. Y42. S1350 M3 T5
G43 Z25. H4 M8
G99 G81 R2. Z-12.76 F150.
G91 Y-8. L4
G90 G80 Z25. M9
G28 Z25. M5
M1
T3
M6
G90 G54 G0 X10. Y10. S800 M3 T1
G43 Z25. H5 M8
G99 G84 R5. Z-12. F640.
G91 Y8. L4
G90 G80 Z25. M9
G28 Z25. M5
G28 X10. Y42.
M30
%
```

Since all comments are missing in the short version, make sure to supply the vital information to the CNC operator in another form, for example in a setup sheet.