1. The machine control unit for a milling machine is equipped with a 16-bit microprocessor. If the total travel distances of x and y-axis are 500 mm and 300 mm, respectively with a leadscrew pitch of 2 mm/rev.

   (a) Calculate the basic length unit for this system.

   (b) What should be the minimum encoder gain, not to lose the BLU? Encoder gain means the number of transmitted pulses per revolution of the encoder?

   Hint: Review Koren Chapter 1, if necessary. "Encoder gain" means the number of transmitted pulses per revolution of the encoder.

2. The maximum table speed of a CNC table is set at 200 mm/sec. Calculate the approximate cycle time of the following part program (unit in mm) assuming the maximum acceleration achievable is 50 mm/sec^2. The tool is in the home position (0,0,0) before the cycle starts. Ignore the cutter dimension.

```
GG90 G17 XYZ
X+200 Y+150
G91 F10
G1 X+30 Y+20
G2 X+40 Y+0 R+20
G2 X-20 Y-20 R+20
G1 X-50
G90 G0 X0Y0
```

3. Generate a part program using APT for the part shown below. The plate hast to be slot milled, hole drilled and outside periphery milled. Assume there are three tools for these purposes. Assume the coordinate of the low left corner at the top surface of the workpiece is (0,0,0) and the tool is positioned at (-20,-20, 20) before machining starts. Follow the following steps: i) define the geometry and ii) use MACRO for programming roughing and finishing milling cycles as shown in Table 1. The periphery of this part is to be milled in two passes with a milling cutter of 0.5 in. in diameter. The first pass will be a rough cut to 0.01 in. of the final geometry specification, and the second pass will be to the final periphery specifications. Then simulate the process using the ATP simulator (download it from the course web site)

   Hint: To perform the roughing pass leaving 0.01 in. of stock, assume a larger cutter diameter than the actual.

Table 1: Machining parameters for roughing and finishing

	spindle speed (rpm)	feed rate (in/min)	turret location for the tool
roughing	**600**	**3.0**	**6**
finishing	**900**	**2.0**	**6**
Slotting	**500**	**3.0**	**4**
Drilling	**600**	**1.0**	**2**

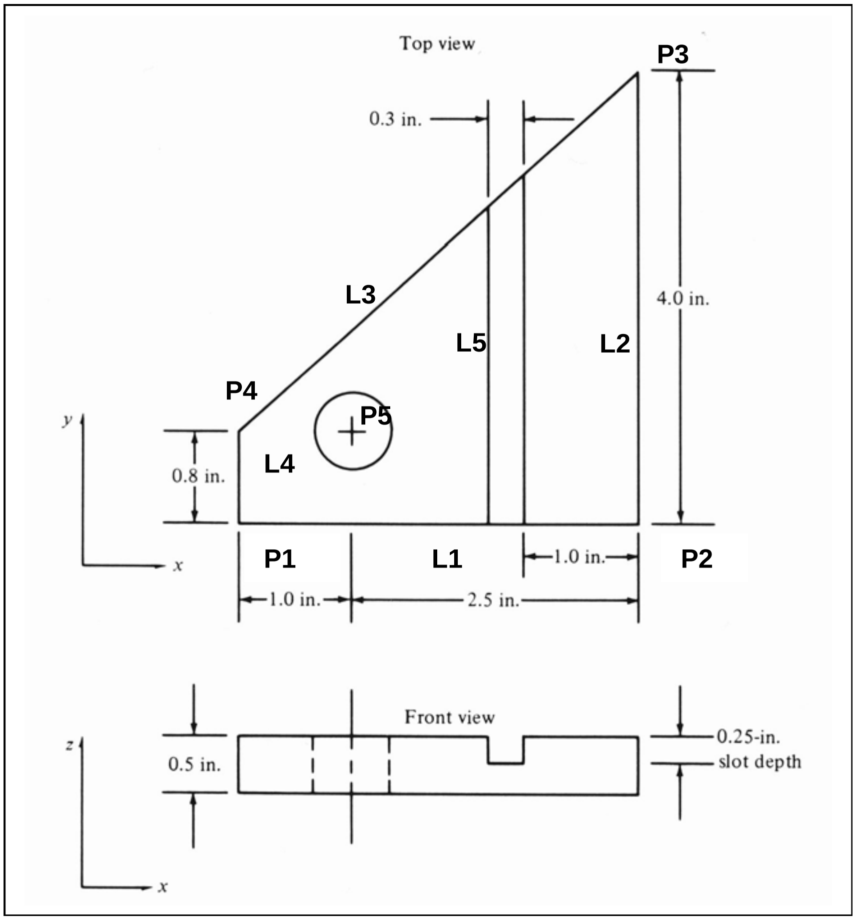

Figure 1 Part geometry and definition

Additional commands:

CUTTER/	specifies cutter diameter in inches, e.g., CUTTER/0.6
SPINDL/	gives spindle rotational speed in rpm, e.g., SPINDL/850
FEDRAT/	specifies feedrate in in/min, e.g., FEDRAT/4.5
TURRET/	specifies a tool from the tool magazine, e.g., TURRET/11

Program Heading

```
PARTNO      P1534
            MACHIN/MMPOST,1
```

Macro Heading

```
MILLS       =MACRO/CUT,SSP,FRT
```

(CUT= cutter diameter, SSP=spindle speed, FRT=feed rate)

```
CALL/MILLS/CUT,SSP,FRT
```