ME317, Design For Manufacturing
Exam 1
December 21, 2006

Name:

Campus Box:

Score:

Please show all your work. Partial credit depends on how well you can justify your answers.
This is an open-book / open-notes exam.

Problem 1 (15 points)
When investigating methods to produce a part, you compared Gray Iron Casting with Aluminum Die Casting. The investigation revealed a fixed cost for the Gray Iron method of about $5000 and about $35000 for the Die Casting. The variable part cost for Gray Iron was $2.26 and was $1.98 for Die Casting.

a) What is the break even production volume?

$5000 + 2.26x = 35000 + 1.98x$

$0.28x = 30,000$

$x = 107,143$ units

b) If we were planning on making more parts than the break even value, which of the two processes would be preferred.

DIE CASTING

c) How many more parts than the break even value would you need to make before you saved your own cost to the company (Assume you worked on this problem for one week at $300/day).

5 DAYS: 1500

1 DAY: 300

$x(2.26 - 1.98) = 1500 \Rightarrow x = 5357$

$x(2.26 - 1.98) = 300 \Rightarrow x = 1500$

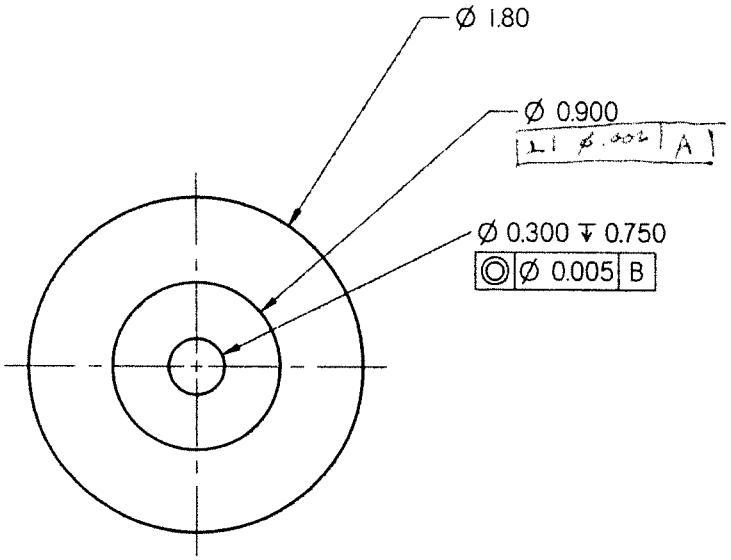
d) Your salary as an engineer is a (direct cost, indirect cost).

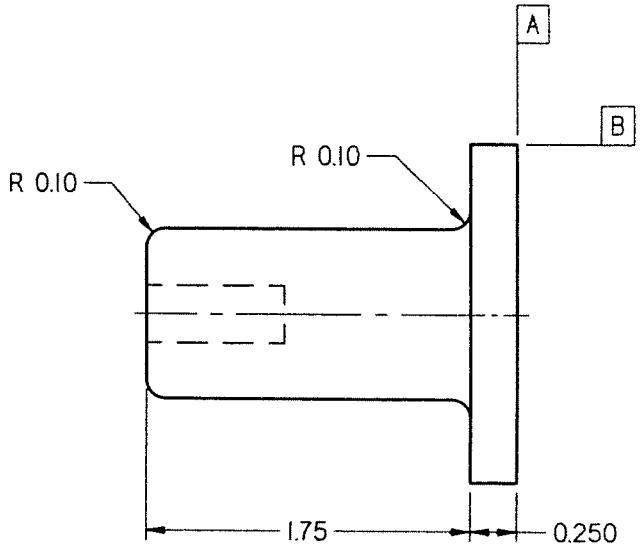
INDIRECT

e) Your salary as an engineer is a (fixed cost, variable cost).

FIXED

REVISION HISTORY			
REV	DESCRIPTION	DATE	APPROVED





Material: Al 6061 T6

	NAME	DATE
DRAWN	stamper	12/20/06
CHECKED		
ENG APPR		
MGR APPR		

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
ANGLES ±XX°
2 PL ±0.02 3 PL ±0.005

SOLID EDGE
UGS - The PLM Company

TITLE: Standoff

SIZE: C | DWG NO | REV

FILE NAME: GDT problem.dft

SCALE: | WEIGHT: | SHEET 1 OF 1

Problem 2
Please refer to the print shown on the back of the prior page to answer the following questions:

The nominal height of this part is 2 inches. What is the smallest possible height this part can have and still be in tolerance? (2 points)

$1.75" + 0.250 - 0.020 - 0.005" = 1.975$ in

Describe in words or pictures the information that is being conveyed by the feature control frame found under the dimension for the 0.300 inch blind hole?
(4 points)

CONCENTRICITY OF THE BLIND HOLE TO CYLINDRICAL DATUM B

Add a feature control frame to the print that ensures that the cylinder with the 0.900 inch diameter is perpendicular to datum A within a circular tolerance zone that has a diameter of 0.002 inches. (4 points)

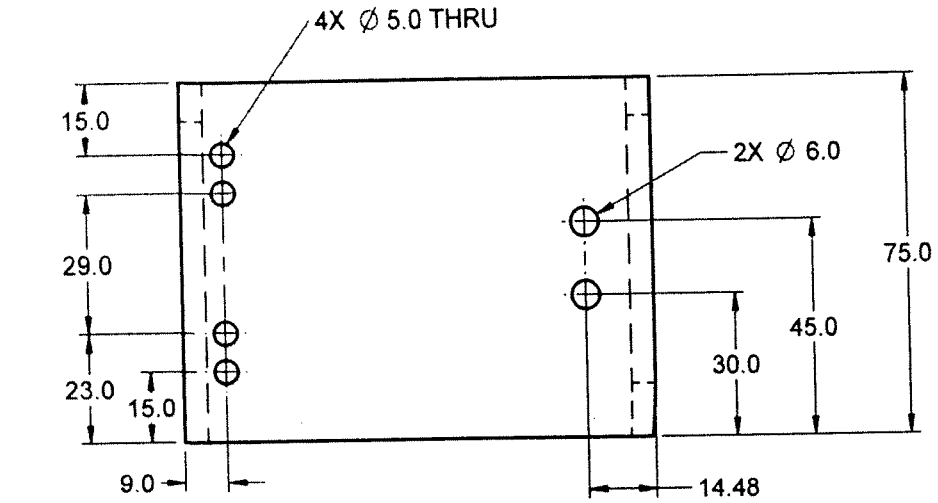
What device would you use to measure the cylinder with the 0.900 inch diameter? (2 points)

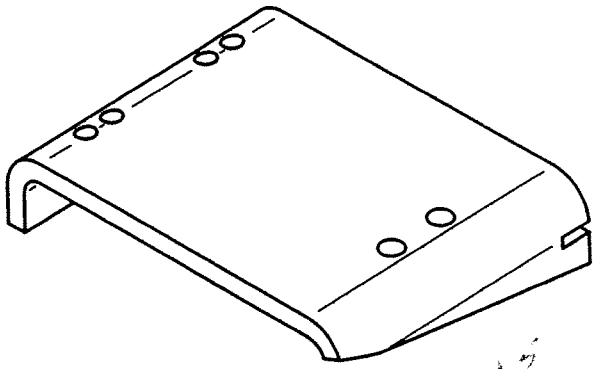
CALIPER

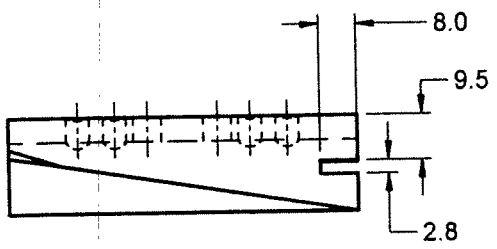
What device would you use to measure the depth of the blind hole? (3 points)

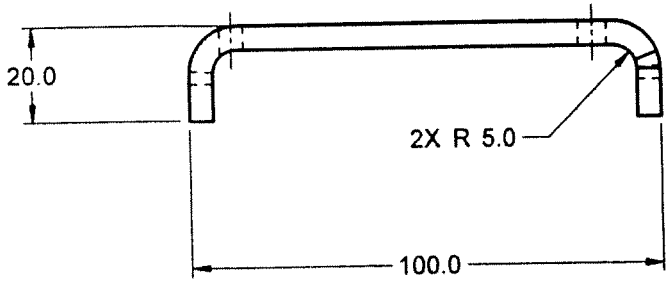
CALIPER

REVISION HISTORY			
REV	DESCRIPTION	DATE	APPROVED









Material - 5 mm thick mild steel

	NAME	DATE
DRAWN	ME317	12/17/06
CHECKED		
ENG APPR		
MGR APPR		

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN MILLIMETERS
ANGLES ±X.X°
1 PL ±0.5 2 PL ±0.05

SOLID EDGE
UGS - The PLM Company

TITLE: **Bracket**

SIZE B | DWG NO | REV

FILE NAME: sheet exam 2006.dft

SCALE: | WEIGHT: | SHEET 1 OF 1

Problem 3
Consider the sheet metal drawing labeled Bracket shown on the back of the prior page. (15 points)

a) Name the four most significant problems you see with production of this part if it is to be made by stamping. For each problem describe **why** it is a problem. (Only the first four will be graded.)

Problem 1

1 to 4

- NARROW SLOT
- SMALL HOLES

Problem 2

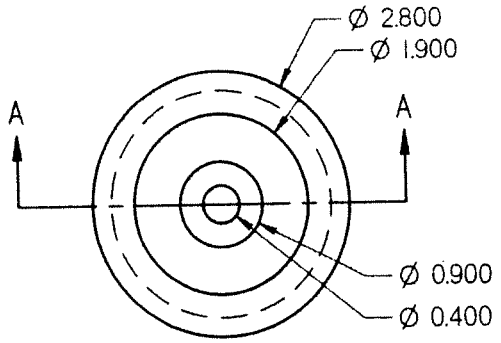
- CLOSE HOLES
- LOCATION TOLERANCES
- HOLES CLOSE TO BEND

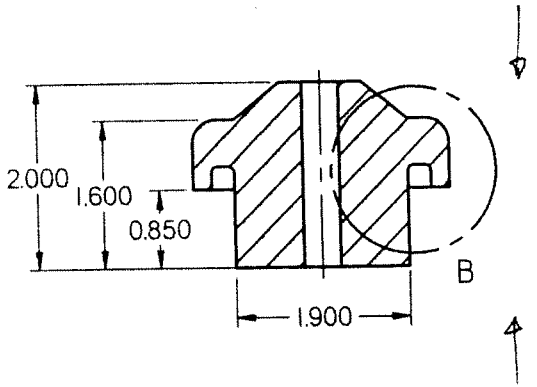
Problem 3

- TOLERANCE STACK-UP ON LEFT SIDE HOLES
- ANGLE NOT SPECIFIED

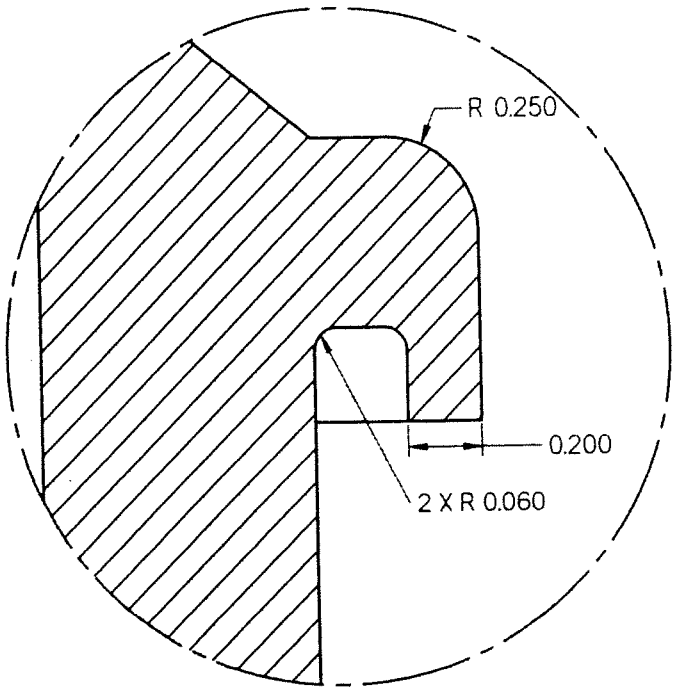
Problem 4

REVISION HISTORY			
REV	DESCRIPTION	DATE	APPROVED





SECTION A-A



DETAIL B

	NAME	DATE
DRAWN	stamperl	12/15/06
CHECKED		
ENG APPR		
MGR APPR		

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
ANGLES ±0.5°
2 PL ±0.05 3 PL ±0.020

SOLID EDGE
UGS - The PLM Company

TITLE: Carriage Bushing

SIZE: C | DWG NO | REV

FILE NAME: PM_part.dft

SCALE: | WEIGHT: | SHEET 1 OF 1

Problem 4
A new engineer brings you a print -shown on the back of the prior page- for a part that is to be produced using a powder metal process. The new engineer is about to send the print to the purchasing department where it will be sent out to vendors for quotes. The engineer asks you to review the print before it is sent to the purchasing department.

What guidance do you have for the new engineer with regards to this print? Feel free to write your comments on the print or the space shown below. (15 points)

- MATERIAL
- REMOVED EDGES
- DEPTH OF GROOVE

1/3

$\frac{2.800 - 1.90}{2} = .200$

3/3 : 15

2/3 : 12 −3

1/3 : 9 −6

0/3 : 4/ SIDES ~~& BOTTOMS~~ MISSING: −10

0/3 : NOTHING GOOD − ~~NO~~ −12

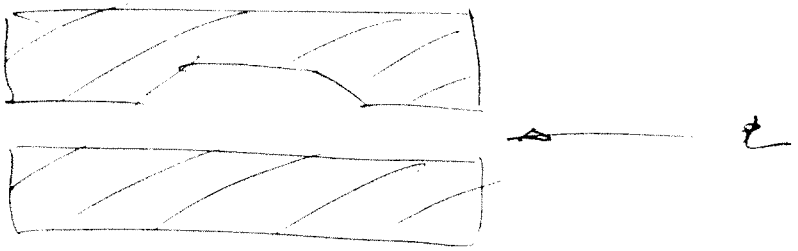
Please indicate the direction of punch travel by drawing an arrow in Section View A-A. (5 points)

Problem 5 (20 points)

a. Rank the following alloys in terms of their relative forgeability. Use a scale of 1 through 5, where 1 is the most forgeable.

Alloy	Rank (1 through 5, with 1 being the best)
Precipitation hardening stainless steel	4
Copper based alloys	2
Niobium based alloys	5
Austenitic stainless steel	3
Aluminum based alloys	1

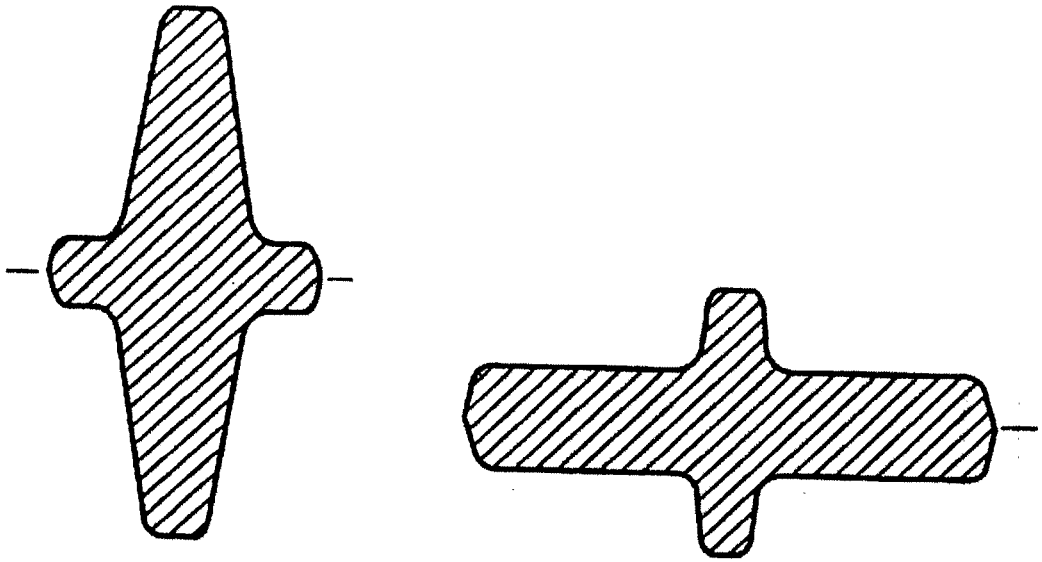
b. Sketch a side view of a forging die. Include a parting line.



c. Should the parting line be contained in one plane? Why or why not?

Yes since [illegible]

d. Of the two cross-sectional shapes shown for a proposed forging, which will be easier to forge? Why?



e. Your company, which manufactures brass valves by forging, has hired a new designer from the P/M industry. The new engineer has given you a drawing of a proposed forged part, but has failed to include any draft angles. What advice can you give the new engineer to improve the drawing?

50 mm

f. The new proposed part drawing (from e) shows some stiffening ribs that are as tall as 5cm relative to the web section of the part. No corner radii are specified. What minimum corner radii do you recommend to improve the forgeabiltiy of the part?

TABLE 3.16.2 $r_{min} = \frac{5}{10}$ mm

1.6 mm → -1