

## INDU 421: Facilities Design and Material Handling Systems

### Assignment 1

1- A foundry has received an order for 20 custom-designed castings. The casting process costs \$700 per unit scheduled. If a casting is good, then it is machined to specifications at an added cost of \$500 per unit. If a casting is not sold, it has a recycle value of \$300. The customer has indicated a willingness to pay \$2000 per casting for 20 acceptable castings; the customer has also agreed to pay \$1500 each for one or two additional castings. However, the customer is unwilling to purchase fewer than 20 or more than 22 castings. Based on historical records, the following probability distribution have been estimated. How many castings should be scheduled for production to maximize expected profit? What is the probability of losing money?

# Good Castings	Number of Castings Scheduled										
	20	21	22	23	24	25	26	27	28	29	30
12	0.10	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	0.10	0.10	0.05	0.05	0.05	0.05	0.00	0.00	0.00	0.00	0.00
14	0.10	0.10	0.10	0.05	0.05	0.05	0.05	0.00	0.00	0.00	0.00
15	0.10	0.10	0.10	0.10	0.05	0.05	0.05	0.00	0.00	0.00	0.00
16	0.10	0.10	0.10	0.10	0.05	0.05	0.05	0.05	0.00	0.00	0.00
17	0.10	0.10	0.10	0.10	0.10	0.05	0.05	0.05	0.05	0.00	0.00
18	0.20	0.10	0.10	0.10	0.10	0.05	0.05	0.10	0.05	0.05	0.05
19	0.10	0.15	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.05	0.05
20	0.10	0.10	0.15	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.05
21	0.00	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
22	0.00	0.00	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
23	0.00	0.00	0.00	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
24	0.00	0.00	0.00	0.00	0.10	0.10	0.10	0.10	0.10	0.10	0.10
25	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.10	0.10	0.10	0.10
26	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05	0.10	0.10	0.10
27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05	0.10	0.10
28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05	0.05
29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05
30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05

2- A foundry produces casting to order. An order for 20 special casting has been received. Since the casting process is highly variable, not all the castings produced are good. The cost of producing each casting is \$550; the additional cost of finishing a good casting is 125\$. If a casting is not good, it is recycled at value of \$75. The customer has agreed to accept 15, 16, 17, 18, 19 or 20 casting at the price of \$1,250, each. If fewer than 15 good castings are produced, none will be purchased by the customer. Probability distributions for the number of good castings produced in a batch of varying size are given at the end of assignment. How many castings should be scheduled in order to maximize expected profit?

3- In the problem 2, suppose the casting are are produced independently with the probability of an individual casting being good being 0.88. Using the binomial distribution to generate the probabilities, determine the optimum number of castings to produce. What is the probability of losing money on the transaction? (Using Excel's binomial distribution function BINOMDIST (x,n,p, False)

# Good Castings	Number of Castings Scheduled															
	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
5	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.05	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.05	0.05	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	0.10	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	0.10	0.10	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	0.15	0.10	0.10	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.15	0.15	0.10	0.10	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00
15	0.20	0.15	0.15	0.10	0.10	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00	0.00	0.00
16	0.00	0.20	0.15	0.15	0.10	0.10	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00	0.00
17	0.00	0.00	0.20	0.15	0.15	0.10	0.10	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00
18	0.00	0.00	0.00	0.20	0.15	0.15	0.10	0.10	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00
19	0.00	0.00	0.00	0.00	0.20	0.15	0.15	0.10	0.10	0.05	0.05	0.05	0.05	0.05	0.05	0.00
20	0.00	0.00	0.00	0.00	0.00	0.20	0.15	0.15	0.10	0.10	0.05	0.05	0.05	0.05	0.05	0.05
21	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.15	0.15	0.10	0.10	0.05	0.05	0.05	0.05	0.05
22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.15	0.15	0.10	0.10	0.05	0.05	0.05	0.05
23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.15	0.15	0.10	0.10	0.05	0.05	0.05
24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.15	0.15	0.10	0.10	0.05	0.05
25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.15	0.15	0.10	0.10	0.05
26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.15	0.15	0.10	0.10
27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.15	0.15	0.10
28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.15	0.15
29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.15
30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20