Final – Spring 2010-11 (June 10, 2011) – Brief Solution Key This solution scheme does not show any reasoning – on the exam, you must show all of your work.

PART II

Problem 1

1. Because it gives a simple number to express whether a process fails/meets/exceeds specification, and it accounts for both mean and variance i.e. whether process is centered on the target value

2.

Supplier	Sample Mean	Sample Standard Deviation	Cpk
A	1.500	0.0030	1
B	1.500	0.0022	1.36
C	1.495	0.0015	0.88

Therefore supplier B is preferable

3. TQM, is the supplier able to build a win-win relationship.
Or: JIT in time, so that the chain is responsive etc.
Or: X-bar and R charts

Problem 2

Stock 30	**p=7**							
	p	A	Demand	Revenues	HC	SC	TC	prob
POOR	7	20	6	42	120	0	120	60%
GOOD	7	50	36	210	0	60	60	40%
				Profit =	TR – TC =	0.6*(42-120) + 0.4*(210-60)		
				Profit =	**$ 13.2**			

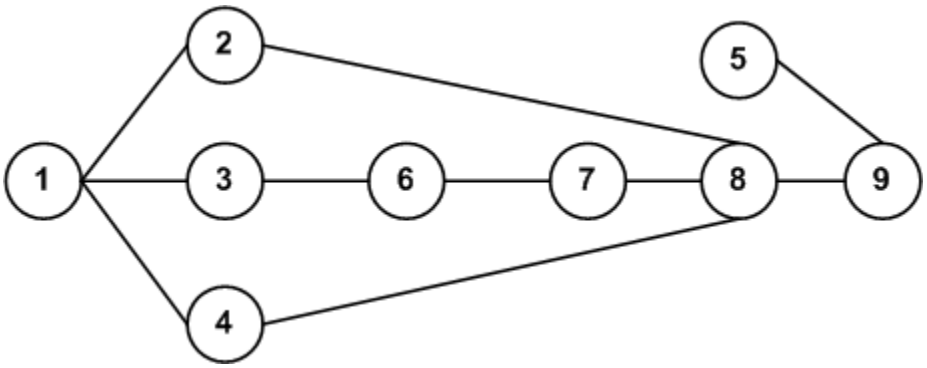
Stock 30	**p=10**							
	p	A	Demand	Revenues	HC	SC	TC	prob
POOR	10	20	0	0	150	0	150	60%
GOOD	10	50	30	300	0	0	0	40%
				Profit =	TR – TC =	0.6*(0-150) + 0.4*(300-0)		
				Profit =	**$ 30**			

Therefore, we pick p=$10

PART III. EXTENDED PROBLEMS

Problem 1

1.



You need to add arrows going from one task to another

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2. Cycle Time =480min/95 dolls = 5.05 mins per doll
   It is ok if you round it to 5 or 5.1

3. #Workstations theoretical = 30minutes/5.05minutes = 5.9 =~6work stations

4. Workstation 1 = {1}, 5min; Workstation 2 = {3, 6}, 5min; Workstation 3 = {2, 8}, 5min; Workstation 4 = {4, 5}, 5min; Workstation 5 = {7}, 5min; Workstation 6 = {9}, 5min.

5. Efficiency = 30minutes / (6stations * 5.05minutes) = 99% . It means that each unit manufactured will incur 1% of idle time (around 0.3 minutes out of 30min)

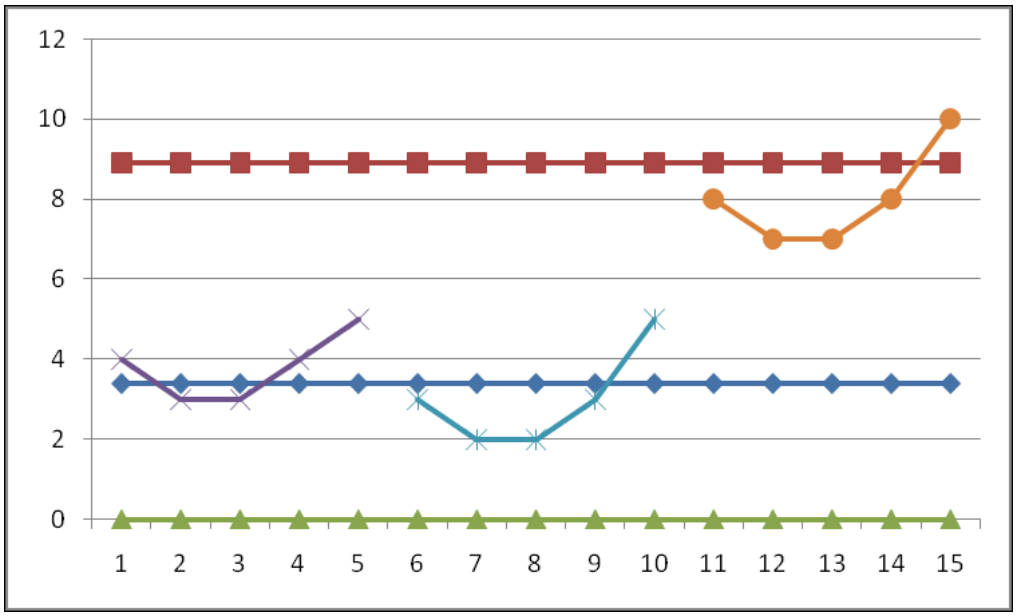
6. The number of workstations ought to increase by 1. Hence Efficiency=30/(7*5.05)=84.86%

Problem 2

1. c-chart- because a c-chart is designed to control the number of defects per unit of output.

2. Mean of c = 3.4; sqrt{bar{c}} =~approx 1.8;
   UCL = bar(c) + 3* bar(c) = 3.4 + 3*1.8 =~8.9
   LCL = max { bar(c) - 3* bar(c), 0} = max {3.4 – 3*1.8, 0} = 0.

3. a. & b.



   There is a cyclical trend where it starts high on Monday goes down on Tuesday and Wednesday picks up on Thursday and reaches a maximum on Friday.

4. Friday is the first day when things went out of control. We could use a control chart for every day of the week. This way on Monday we could have noticed that something is wrong. We expect the average and standard deviation would be lower…

5. The manufacturer could track the number of dolls that are defective out of a sample of dolls per day; this can be tracked via a p-chart.

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Problem 3

1. ROP1 = d*LT = (12500/50) * 1 = 250
   ROP2 = (12500/50) * 2 = 500

2. All costs are the same except for holding which is lower for the POQ model
   HC = H*(1-d/p) and hence you should pick Supplier 2 (POQ model)
   HC = 100*(1-0.714) = $28.6 = H2

3. Q=1000. To be indifferent both total costs need to be the same
   H1*Q/2 + S*D/Q + c1*D = H2*Q/2 + S* D/Q + c2*D
   Hence c1 = (H2-H1)*Q/(2D) +c2= ……

4. a. S (is ordering or setup cost), when mentioned "charge the same transportation cost per order equal to $650/order" - This means it's ordering cost, S = $650 per order
   The production rate (p) is given as "the order arrives in small batches of 350 units per week" - So, p = 350 units/week
   You can use p as weekly production rate instead of daily, since you use with it the weekly demand rate d = 12500/50 = 250

   CASE1: Q*1=sqrt(2DS/H)= sqrt(162500) = 403.11
   CASE2: Q*2= sqrt [(2DS) / H(1- d/p)] = sqrt [16250000/28.57] = 754.17
   Supplier 2 incurs less holding cost and so retailer can afford a larger quantity all else equal

   b. TC1=H1Q*1+D1c1 = $ …
   TC2=H2Q*2+D2c2 = $ …
   Pick the supplier that guaranties the lowest cost (it is supplier 2 again)

5. ROP1=250+1.67*90=397.6
   ROP2=500+1.67*sqrt(2)*90 = 708.7
   Yes because in this case the SS stock is too high, this will impact the holding cost on average
   208*60=12480