

ESCUELA SUPERIOR POLITECNICA DEL LITORAL

Administración de Operaciones

Examen Final

Term. II, 2018

Yo,, al firmar este compromiso, reconozco que el presente examen está diseñado para ser resuelto de manera individual, que puedo usar una calculadora ordinaria para cálculos aritméticos, un lápiz o esferográfico; que sólo puedo comunicarme con la persona responsable de la recepción del examen; y, cualquier instrumento de comunicación que hubiere traído, debo apagarlo y depositarlo en la parte anterior del aula, junto con algún otro material que se encuentre acompañándolo. No debo además, consultar libros, notas, ni apuntes adicionales a las que se entreguen en esta evaluación. Los temas debo desarrollarlos de manera ordenada. Como estudiante de ESPOL me comprometo a combatir la mediocridad y actuar con honestidad, por eso no copio ni dejo copiar. Firmo al pie del presente compromiso, como constancia de haber leído y aceptar la declaración anterior.

Firma: Nro.Matricula:

Paralelo:

- 1.) Which of the following is the best definition of the inventory position?
 - a. The amount of inventory on hand.
 - b. The amount of inventory needed to meet demand during the lead time.
 - c. The amount of on-hand inventory plus the amount of inventory ordered and waiting to arrive.
 - d. The amount of inventory ordered and waiting to arrive.

- 2.) The Williams Manufacturing Company produces wheelchairs. Each wheelchair is made from the following parts: 1 unit of Part A, 2 unit of Part B, and 1 unit of Subassembly C. Each subassembly C is made up of 1 units of Part D, 4 units of Part E, and 3 units of Part F.
 - a. Develop a material structure tree for wheelchairs.

- 5.) The Taylor accounting firm has purchased a new computer system. Several activities need to be completed to make sure the system works properly before being used. The following gives information about this project. How long will it take to install the system and what is the critical path?

Activity	Immediate Predecessor	Time (weeks)
A	--	3
B	--	4
C	A	6
D	B	2
E	A	5
F	C	2
G	D, E	4
H	E, F	5

Economic Order Quantity (EOQ) Model and Other Related Equations :

$$\text{Annual Ordering Cost: } \text{Annual Ordering Cost} = \frac{D}{Q} C_o$$

$$\text{Annual Holding Cost: } \text{Annual Holding Cost} = \frac{Q}{2} C_h$$

$$\text{Economic Order Quantity: } EOQ = Q^* = \sqrt{\frac{2DC_o}{C_h}}$$

$$\text{Average Inventory Level: } \text{Average Inventory Level} = \frac{Q}{2}$$

$$\text{Reorder Point when daily demand and lead time are known: } R = dL$$

$$\text{Reorder Point when daily demand is normally distributed, but the lead time is known: } R = \bar{d}L + Z\sigma_d\sqrt{L}$$

$$\text{Reorder Point when daily demand is known, but the lead time is normally distributed: } R = d\bar{L} + Z(d\sigma_L)$$

Reorder Point when both daily demand and the lead time are normally distributed:

$$R = d\bar{L} + Z\left(\sqrt{\bar{L}\sigma_d^2 + \bar{d}^2\sigma_L^2}\right)$$

$$\text{How to find } Z: Z = \frac{x-\mu}{\sigma}$$

$$\text{Total Annual Holding Cost with Safety Stock: } THC = \frac{Q}{2} C_h + (SS)C_h$$

Production Run Model and Other Related Equations

$$\text{Annual Holding Cost: } \text{Annual Holding Cost} = \frac{Q}{2} \left(1 - \frac{d}{p}\right) C_h$$

$$\text{Annual Setup Cost: } \text{Annual Setup Cost} = \frac{D}{Q} C_s$$

$$\text{Optimal Production Quantity: } Q^* = \sqrt{\frac{2DC_s}{C_h\left(1 - \frac{d}{p}\right)}}$$

Quantity Discount Model (Equations needed)

$$\text{EOQ that includes the price (C): } EOQ = \sqrt{\frac{2DC_o}{IC}}$$

$$\text{Total Cost: } TC = DC + \frac{D}{C} C_o + \frac{Q}{2} C_h$$

Marginal Analysis with Discrete Distributions

$$\text{Decision Rule: } P \geq \frac{ML}{MP+ML}$$

Equations Related to Design of Goods and Services

$MTBF \equiv \text{Mean Time Between Failures}$

$MTTR \equiv \text{Mean Time to Repair}$

System Availability: $SA = \frac{MTBF}{MTBF+MTTR}$

Waiting Line Analysis Equations:

$\lambda \equiv \text{Mean Arrival Rate}$

$\mu \equiv \text{Mean Service Rate}$

The probability that no customers are in the queuing system (either in the queue or being served):

$P_0 = \left(1 - \frac{\lambda}{\mu}\right)$

The probability of exactly n customers in the queuing system: $P_n = \left(\frac{\lambda}{\mu}\right)^n \cdot P_0$

The average number of customers in the queuing system (i.e., the customers being serviced and in the waiting line): $L = \frac{\lambda}{\mu-\lambda}$

The average number of customers in the waiting line: $L_q = \frac{\lambda^2}{\mu(\mu-\lambda)}$

The average time a customer spends in the queuing system (i.e., waiting and being served): $W = \frac{1}{\mu-\lambda}$

The average time a customer spends waiting in line to be served: $W_q = \frac{\lambda}{\mu(\mu-\lambda)}$

The probability that the server is busy and a customer has to wait, known as the utilization factor: $\rho = \frac{\lambda}{\mu}$

The probability that the server is idle and a customer can be served: $I = 1 - \rho$

Equations Related to Sales and Operations Planning

Optimal Probability of Demand or No-Shows = $\frac{C_u}{C_u+C_o}$

Where *Cost of Underbooking or Underestimating demand* $\equiv C_u$ and
Cost of Overbooking or Overestimating Demand $\equiv C_o$

Equations Related to Project Management

Expected Activity Time: $t = \frac{a+4m+b}{6}$

Variance of Activity Completion Time: $Variance = \left(\frac{b-a}{6}\right)^2$

Earliest Finish Time: $EF = ES + t$

Latest Start Time: $LS = LF - t$

Slack: $Slack = LS - ES$ or $Slack = LF - EF$

Project Variance: $Project\ Variance = \sum Variance\ of\ Activities\ on\ the\ Critical\ Path$

Project Standard Deviation: $Project\ Standard\ Deviation = \sqrt{Project\ Variance}$

Value of Work Completed:

$$\text{Value of Work Completed} = (\text{Percent of work completed}) * (\text{Total Activity Budgeted})$$

$$\text{Activity Difference: Activity Difference} = \text{Actual Cost} - \text{Value of Work Completed}$$

$$\text{Crash Cost per Time Period: Crash Cost per Time Period} = \frac{\text{Crash Cost} - \text{Normal Cost}}{\text{Normal Time} - \text{Crash Time}}$$

	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.50000	.50399	.50798	.51197	.51595	.51994	.52392	.52790	.53188	.53586
0.1	.53983	.54380	.54776	.55172	.55567	.55962	.56356	.56749	.57142	.57535
0.2	.57926	.58317	.58706	.59095	.59483	.59871	.60257	.60642	.61026	.61409
0.3	.61791	.62172	.62552	.62930	.63307	.63683	.64058	.64431	.64803	.65173
0.4	.65542	.65910	.66276	.66640	.67003	.67364	.67724	.68082	.68439	.68793
0.5	.69146	.69497	.69847	.70194	.70540	.70884	.71226	.71566	.71904	.72240
0.6	.72575	.72907	.73237	.73563	.73891	.74215	.74537	.74857	.75175	.75490
0.7	.75804	.76115	.76424	.76730	.77035	.77337	.77637	.77935	.78230	.78524
0.8	.78814	.79103	.79389	.79673	.79955	.80234	.80511	.80785	.81057	.81327
0.9	.81594	.81859	.82121	.82381	.82639	.82894	.83147	.83398	.83646	.83891
1.0	.84134	.84375	.84614	.84849	.85083	.85314	.85543	.85769	.85993	.86214
1.1	.86433	.86650	.86864	.87076	.87286	.87493	.87698	.87900	.88100	.88298
1.2	.88493	.88686	.88877	.89065	.89251	.89435	.89617	.89796	.89973	.90147
1.3	.90320	.90490	.90658	.90824	.90988	.91149	.91309	.91466	.91621	.91774
1.4	.91924	.92073	.92220	.92364	.92507	.92647	.92785	.92922	.93056	.93189
1.5	.93319	.93448	.93574	.93699	.93822	.93943	.94062	.94179	.94295	.94408
1.6	.94520	.94630	.94738	.94845	.94950	.95053	.95154	.95254	.95352	.95449
1.7	.95543	.95637	.95728	.95818	.95907	.95994	.96080	.96164	.96246	.96327
1.8	.96407	.96485	.96562	.96638	.96712	.96784	.96856	.96926	.96995	.97062
1.9	.97128	.97193	.97257	.97320	.97381	.97441	.97500	.97558	.97615	.97670
2.0	.97725	.97784	.97831	.97882	.97932	.97982	.98030	.98077	.98124	.98169
2.1	.98214	.98257	.98300	.98341	.98382	.98422	.98461	.98500	.98537	.98574
2.2	.98610	.98645	.98679	.98713	.98745	.98778	.98809	.98840	.98870	.98899
2.3	.98928	.98956	.98983	.99010	.99036	.99061	.99086	.99111	.99134	.99158
2.4	.99180	.99202	.99224	.99245	.99266	.99286	.99305	.99324	.99343	.99361
2.5	.99379	.99396	.99413	.99430	.99446	.99461	.99477	.99492	.99506	.99520
2.6	.99534	.99547	.99560	.99573	.99585	.99598	.99609	.99621	.99632	.99643
2.7	.99653	.99664	.99674	.99683	.99693	.99702	.99711	.99720	.99728	.99736
2.8	.99744	.99752	.99760	.99767	.99774	.99781	.99788	.99795	.99801	.99807
2.9	.99813	.99819	.99825	.99831	.99836	.99841	.99846	.99851	.99856	.99861
3.0	.99865	.99869	.99874	.99878	.99882	.99886	.99889	.99893	.99896	.99900
3.1	.99903	.99906	.99910	.99913	.99916	.99918	.99921	.99924	.99926	.99929
3.2	.99931	.99934	.99936	.99938	.99940	.99942	.99944	.99946	.99948	.99950