BITS Pilani

Dubai Campus

Course: Operations Research
Course No. AAOC C312/ MATH F242
Max marks: 40   Weightage: 40%   Date: 05-06-2014   Time: 3 Hours   Year: III & IV

NOTE: Graph paper is not required.

1. The following data on the amount of time (in minutes) it took a person to drive to work, Monday through Friday, along four different routes:

	Monday	Tuesday	Wednesday	Thursday	Friday
Route 1	22	26	25	25	31
Route 2	25	27	28	26	29
Route 3	26	29	33	30	33
Route 4	26	28	27	30	30

    Use Randomized Block Design to test at the 0.05 level of significance for H_0: the differences among the means obtained for the different routes are not significant and also another H_0: the differences among the means obtained for the different days of the week are not significant. [4]

2. A large corporation wants to choose between two brands of light bulbs. Brand A is less expensive than Brand B. Hence the corporation would like to buy brand A unless there is a strong evidence to indicate that brand B has a larger life. For this purpose, 7 bulbs of brand A were tested for their life lengths (in hours) and the following results were recorded as their life-lengths: 981, 982, 1342, 1051, 1005, 976, 1016 and 9 bulbs of brand B were found to have the following life-lengths 1380, 1004, 1032, 1263, 1040, 990, 1102, 1170, 1405. Using the rank-sum test at a level of significance at most 0.05, what decision would be made? Justify. [4]

3. The following sample data pertain to the shipments received by a large form from three different vendors:

	Number rejected	Number imperfect but acceptable	Number perfect
Vendor A	63	42	15
Vendor B	58	61	31
Vendor C	14	47	29

    Test at the 0.01 level of significance whether the three vendors ship products of equal quality.[4

9. One two wheeler manufacturing company experienced irregular but usually increasing demand for their bikes. The demand was found to be 420 bikes for June and 440 bikes for July, 450 for August, 500 for September and 550 for October. Use exponential smoothing technique to forecast the sale for the November taking smoothing constant α =0.4. Calculate Mean Absolute Deviation. [4]

10.
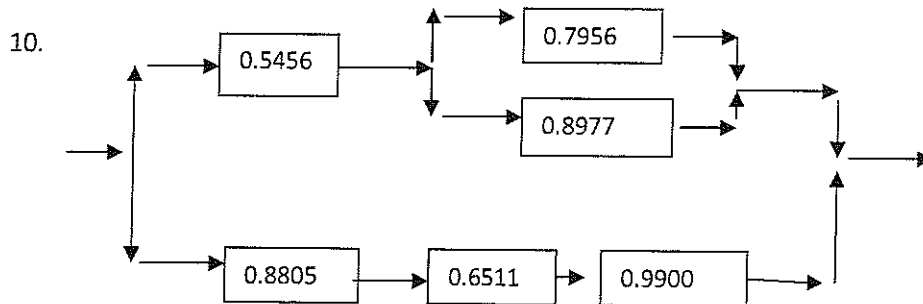
Find the reliability of the system connected as above where the numbers inside the boxes indicate the reliabilities of the corresponding components. Assume that the components function independently. *In all steps at least four decimal places must be considered.* [4]

TABLE VALUES (as per the standard notation):

$F_{3,12;0.95} = 3.49$, $F_{4,12;0.95} = 3.26$, $\chi^2_{4;0.99} = 13.277$, $\chi^2_{4;0.95} = 9.488$, $\chi^2_{17;0.95} = 27.587$

For n= 4; $A_2 = 0.729$

Model-III: (M/M/s) : (FCFS/∞ / ∞)

1) $P_0 = \dfrac{1}{\dfrac{\rho^s}{s!(1-\dfrac{\rho}{s})} + \sum\limits_{n=0}^{s-1} \dfrac{\rho^n}{n!}}$, $\rho = \dfrac{\lambda}{\mu}$, $\rho < s$

2) $P_n = \dfrac{\rho^n}{n!} P_0$, $n = 0, 1, 2, ..., s-1$

$= \dfrac{\rho^n}{s!s^{n-s}} P_0$, $n = s, s+1, s+2, ...$

3) $L_q = \dfrac{\rho^s}{s!} \dfrac{\lambda\mu s}{(\mu s - \lambda)^2} P_0$.

4) $L = \dfrac{\rho^s}{s!} \dfrac{\lambda\mu s}{(\mu s - \lambda)^2} P_0 + \rho$.

For n =7 and m=9		
X	P	x*
75	0.057	44
76	0.045	43
77	0.036	42

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Second Semester 2013-2014
TEST -II (OB)

Course: Operations Research
Course No. AAOC C312 / MATH F 242
Max marks: 20   **Weightage: 20%**
Date: 04-05-2014   **Time: 50 Minutes**
Year: III

1. In the comparison of two kinds of paint, a consumer testing service finds that four 1-gallon cans of one brand cover on the average 546 feet with a standard deviation of 31 square feet, whereas four 1-gallon cans of another brand cover on the average 492 square feet with a standard deviation of 26 square feet. Assuming that the two populations sampled are normal and have equal variances, test H_0: $\mu_1 - \mu_2 = 0$ against the H_1: $\mu_1 - \mu_2 > 0$ at 5% level of significance.   [4]

2. In a certain study following observations were recorded for the amount of time (in months) a surveillance camera would run without having to be reset.
   4.1, 6.3, 5.3, 3.5, 0.3
   Use the Kolmogorov- Smirnov test at 5% level to test whether these data could have come from an exponential population with mean 4 months. (Calculate values upto three decimal places).[4]

3. Under normal and controlled conditions, a process produces 10, 20, 30, 40 percent items of type A, B, C, D respectively. A random sample of 100 items gave 5, 20, 30 and 45 items of type A, B, C, D respectively. Using the chi-square test at 5% level of significance test H_0: The process was working under normal and controlled conditions. [4]

4. The following are 15 measurements of the octane rating of a certain kind of gasoline: 97.5, 95.2, 97.3, 96.0, 96.8, 100.3, 97.4, 95.3, 93.2, 99.1, 96.1, 97.6, 98.2, 98.5 and 94.9. Use the Wilcoxon signed –rank test at 5% level of significance to test whether the mean octane rating of the given kind of gasoline is 98.5. [4]

5. A parking lot has 5 parking spaces of cars. Cars arrive, for parking at the lot, in a Poisson process at a rate of 8 cars per hour. The parking time of a car is exponentially distributed with a mean of 30 minutes. When all the 5 parking spaces are occupied, then any car that arrives goes elsewhere for parking.
   a) What fraction of cars, are lost as customers arrive to this parking lot.
   b) What is the per hour effective rate of service of the parking lot?
   c) Find the proportion of time the server is idle.   [4]

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Second Semester 2013-2014
TEST -I (CB)

Course: Operations Research
Course No. AAOC C312 / MATH F 242
Max marks: 25   **Weightage: 25%**
Date: 13-03-2014   **Time: 50 Minutes**
Year: III

1. The following data give the means & ranges of 10 samples, each consisting of 4 values:

Sample No	1	2	3	4	5	6	7	8	9	10
$\bar{X}$	38	42	43	29	44	45	49	39	40	41
R	1.3	2	2.7	4	1.5	6	2.1	2.6	3.1	3.2

   a) Use the data to find CL, UCL and LCL for an $\bar{X}$ chart.
   b) Draw the control chart for mean. [Graph sheet is not required]
   c) Is the process under control?   [4]

2. In a bank, every 15 minutes one customer arrives for cashing the cheque. The staff at the payment counter takes 10 minutes on an average to serve the customer. Assume arrival pattern follows Poisson distribution and service times follow exponential distribution.
   a) What is the probability that an arriving customer will have to wait in the system?
   b) What is the average queue length?
   c) What is the probability that there are exactly 3 customers in the system?   [5]

3. The demand of a product is 500 units per day and the delivery rate is 800 units per day. Shortages are allowed and are fully backlogged. The cost of placing an order is Rs. 1000/. The purchase cost is Rs 60 per unit and the cost of storing goods in the warehouse is Rs 10 per unit. In case of shortages, cost is Rs 15 per unit. Assume that the lead time is zero. Find the following:
   a) Economic Order Quantity.
   b) Optimum Order Cycle.
   c) Economic Backorder quantity.
   d) TCU*   [7]

4. One two- wheeler manufacturing company experienced irregular but usually increasing demand for the bikes. The demand was found to be 420 bikes for June, 440 for July, 450 for August, 500 for September and 550 for October. Use exponential smoothing technique to forecast the sale for the November taking smoothing constant $\alpha = 0.4$. Calculate MAD.   [5]

5. Assume that, in a single period probabilistic inventory model where the demand occurs instantaneously at the beginning of the period and filled instantaneously, the demand of the item is N(200, 16) variate. Given $I = 10$, $Co = 60$, $C1 = 10$, $C2 = 90$ AND $K = 0$, find the value of R*.   [4]

   [**TABLE VALUES** (As per standard notation):
   F $(Z = -0.5244) = 0.3$,
   For n =4, $A_1 = 1.880$ & $A_2 = 0.729$]

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Second Semester 2013-2014
QUIZ-II (CB)
Course: Operations Research   Course No. AAOC C312 / MATH F 242
Max marks: 7   Weightage: 7%   Date: 11-05-2014   Time: 15 Minutes   Year: III

NAME:
ID NO:

1. Which of the following is a correct interpretation of a significant t test result when comparing two mean scores using an alpha level of .05?

   a) There is less than a 5% chance the observed difference is due to chance.
   b) There is less than a 5% chance the observed difference is a result of the treatment.
   c) There are no differences between the means.
   d) There is less than a 1% chance the observed difference is due to chance.
   e) None of the above

2. A political scientist surveys the party affiliations of physicists and economists:

	Liberal	Conservative	NDP
Economists	45	63	12
Physicists	50	21	35

   Test the null hypothesis that both Economists and Physicists are uniformly affiliated with the parties.

   a) Value of the test statistic is _____

3. An insurance company is reviewing its current policy rates. When originally setting the rates they believed that the average claim amount was $1,800. They are concerned that the true mean is actually higher than this, because they could potentially lose a lot of money. They randomly select 40 claims, and calculate a sample mean of $1,950. The standard deviation of claims is $500. Use $\alpha = 0.025$.
   a) H_0: _____ H_1 : _____
   b) If $Z = 1.89$ and $Z_{0.975} = 1.96$. Inference is _____ H_0
   c) It is subject to _____ error.

4. _____ tests are not dependent upon the restrictive normality assumption of the population.

Second Semester 2013-2014
QUIZ-I (CB)

| Course: Operations Research | Course No. AAOC C312 / MATH F 242 |

Max marks: 8   Weightage: 8%   Date: 10-04-2014   Time: 20 Minutes   Year: III

NAME:
ID NO:

1. A queuing system represented by Kendal's notation $(M/M/x)$: $(FCFS/x^2+4x/3x+12)$. If the maximum number of customers allowed in the system is equal to the prospective size of population, then no. of servers working are _____.

2. The arrival rate of customers is 9 per hour and service rate is 2 per hour. Both arrival and service times follow exponential distribution. The minimum number of servers required to avoid an infinite queue are _____.

3. Cars arrive at car wash facility in a Poisson process at mean rate of 10 cars /hr for car wash. The service station has three washing facilities working in parallel each with mean service rate of 10 cars/hr. Service times are exponentially distributed. The cars are served in the order that they arrive. There is space for only three cars being served and two in waiting. If all spaces are filled up then the car will go to another facility and probability that the car wash facility is full is given as 0.0635. Specify the following:

    a) Number of cars that can enter the system are _____
    b) Effective arrival rate_____

4. To test Ho: $\mu = 50$ versus H_1: $\mu < 50$, where μ is the mean of a normal population. A sample of size 25 is drawn from the population and the mean and variance obtained are 30 and 16 respectively.
    a) Specify the suitable test statistic _____
    b) Calculated value of the test statistic is _____

5. The probability that Ho is accepted when Ho is false is 0.435. The power of the test is

    _____.

6. To test Ho: $\sigma = 6$ versus H1: $\sigma \neq 6$ when the population follows normal distribution. A sample of size 30 is drawn and the variance is 25. At 10% level of significance the critical region is
    a) $\chi^2 > \chi^2_{29, 0.95}$
    b) $\chi^2 > \chi^2_{29, 0.975}$
    c) $\chi^2 > \chi^2_{30, 0.975}$
    d) $\chi^2 > \chi^2_{30, 0.95}$