**ASSIGNMENT-4**

**Week 12 –week 14**

**QUANTITATIVE METHODS**

**(STAT-201)**

**Student Full Name**:

**Student ID**:

**CRN No**.:

**Note**: 1. All the questions are compulsory.

2. Due date: December 23, 2017 11:59 PM

3. Points: Section-I 1×6=6

Section-II 1×6=6

Section-III 6×3=18

Total 30

**Section-I**

***State whether the following statements are True or False.* (1×6 = 6)**

1. A *predecessor activity* is one that must be accomplished before the given activity can be started. (True)
2. The CPM assigns just one time estimate to each activity while PERT employs a probability distribution based on three time estimates for each activity. (True)
3. Gantt charts contain information about the time taken by each activity, but not about the sequential dependencies of the activities. (True)
4. Simulation models are designed to generate optimal solution, which can then be applied to real –world situations. (False)
5. Simulation does not interfere with the real world system. (True)
6. If we are using a Monte Carlo simulation model, the average simulation demand must be equal to the expected demand. (False)

**Section-II**

***Circle/tick the right answer from the answers given below.* (1×6 = 6)**

1. Which of the following questions can be answered by PERT?
2. When is the entire project expected to be completed?
3. What is the probability that the project will be completed by a specific date?
4. What are the critical activities?
5. All of the above
6. The critical path of a network is the
7. path with zero slack.
8. path with the least variance.
9. path with the most activities.
10. path with the largest variance.
11. Given an activity's optimistic, most likely, and pessimistic time estimates of 4, 7, and 16 days respectively, then the PERT expected activity time and variance for this activity will be respectively:
12. 8 and 4
13. 4 and 8
14. 4 and 2
15. 8 and 2
16. If the simulation is repeated thousand time, it is much more likely that
    1. average simulation demand will be two times the expected demand.
    2. average simulation demand will nearly the same as the expected demand.
    3. average simulation demand will be half of the expected demand.
    4. all the above.

1. A meteorologist was simulating the number of days that rain would occur in a month. The random number interval from 01 to 30 was used to indicate that rain occurred on a particular day, and the interval 31–00 indicated that rain did not occur. What is the probability that rain did occur?
   1. 0.30
   2. 0.31
   3. 1.00
   4. 0.70

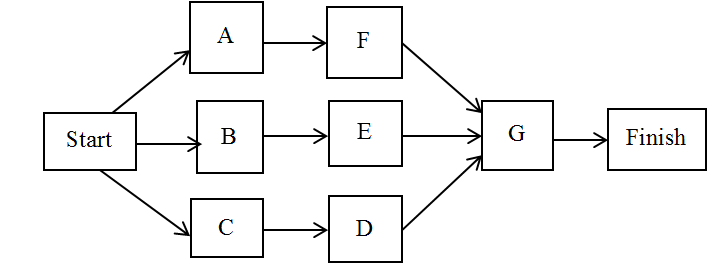
1. In assigning random numbers in a Monte Carlo simulation,
   1. it is important to develop a cumulative probability distribution.
   2. it is important to use a normal distribution for all variables simulated.
   3. it is not important to assign probabilities to an exact range of random number intervals.
   4. All of the above

**Section-III**

**Answer the following Essay Type Questions (6**×3=18)

1. Given the following project network and table.

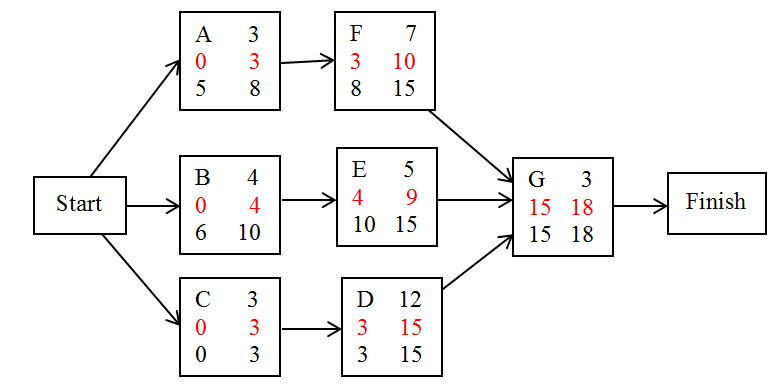
|  |  |  |
| --- | --- | --- |
| Activity | Estimated  Activity Time (weeks) | Immediate Predecessors |
| A | 3 | - |
| B | 4 | - |
| C | 3 | - |
| D | 12 | C |
| E | 5 | B |
| F | 7 | A |
| G | 3 | D, E, F |



1. Fill in the table to give the immediate predecessor(s) for each activity.
2. What will be the project's estimated completion time?
3. Identify Critical activities and the critical path.

Solution:

1. See the table



1. The project's estimated completion time =18
2. Since activities C, D and G have 0 slack, there C, D and G are critical activities. The path through these activities will be a critical path i.e. C → D → G
3. In a project following are the activities’ ES, LS, EF and LF times

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Activity | Earliest start (ES) | Latest start (LS) | Earliest finish (EF) | Latest finish (LF) | Slack | Activities are on Critical path  **Yes or No** |
| A | 0 | 0 | 5 | 5 |  |  |
| B | 0 | 6 | 6 | 12 |  |  |
| C | 5 | 8 | 9 | 12 |  |  |
| D | 5 | 7 | 8 | 10 |  |  |
| E | 5 | 5 | 6 | 6 |  |  |
| F | 6 | 6 | 10 | 10 |  |  |
| G | 10 | 10 | 24 | 24 |  |  |

1. Fill the blank space in the table
2. What are the critical activities?

Solution:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Activity | Earliest start (ES) | Satest start (LS) | Earliest finish (EF) | Latest finish (LF) | Slack  (LS-ES) | Activities are on Critical path  **Yes or No** |
| A | 0 | 0 | 5 | 5 | 0 | Yes |
| B | 0 | 6 | 6 | 12 | 6 | No |
| C | 5 | 8 | 9 | 12 | 3 | No |
| D | 5 | 7 | 8 | 10 | 2 | No |
| E | 5 | 5 | 6 | 6 | 0 | Yes |
| F | 6 | 6 | 10 | 10 | 0 | Yes |
| G | 10 | 10 | 24 | 24 | 0 | Yes |

1. A, E, F and G are critical activities.

**Use the following information to answer the questions 3 and 4.**

The demand for a STAT201 textbook from an online bookstore is observed to be the following during the historical data of last semesters:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Demand (per week) | Frequency | Probability of occurrence | Cumulative probability | Interval for random numbers |
| 0 | 5 | 0.3125 | 0.31 | 01 – 31 |
| 1 | 3 | 0.1875 | 0.50 | 32 – 50 |
| 2 | 2 | 0.1250 | 0.63 | 51 – 63 |
| 3 | 1 | 0.0625 | 0.69 | 64 – 69 |
| 4 | 2 | 0.1250 | 0.81 | 70 – 81 |
| 5 | 2 | 0.1250 | 0.94 | 82 – 94 |
| 6 | 1 | 0.0625 | 1 | 95 – 00 |
| Total | 16 | 1 | – | – |

1. Set up the probability and cumulative probability distribution for the textbook demand (round the cumulative probabilities to 2 decimal digits).
2. Establish random number intervals for the variable and calculate the average demand over 5 week period using the random numbers 15, 84, 23, 42, 67.

|  |  |  |
| --- | --- | --- |
| Week | Random Number | Simulated Demand |
| 1 | 15 | 0 |
| 2 | 84 | 5 |
| 3 | 23 | 0 |
| 4 | 42 | 1 |
| 5 | 67 | 3 |
|  | Total | 9 |

Average demand = Total / 5 weeks

=9/5 = 1.8 books per week

**Use the following information to answer the questions 5 and 6.**

The head of emergency department in a hospital wants to study the arrival of patients needing urgent care during the 48 hours of the weekends. The probability of the urgent patients’ arrival per hour is observed to be the following:

|  |  |  |  |
| --- | --- | --- | --- |
| Number of urgent patients arriving | Probability | Cumulative probability | Intervals of random numbers |
| 0 | 0.35 | 0.35 | 01 – 35 |
| 1 | 0.3 | 0.65 | 36 – 65 |
| 2 | 0.15 | 0.80 | 66 – 80 |
| 3 | 0.15 | 0.95 | 81 – 95 |
| 4 | 0.05 | 1 | 96 – 00 |

1. Establish random number intervals for the variable of number of urgent patients arriving per hour during the weekends.
2. Simulate the arrival of urgent patients during 10 hours, using the following double digit random numbers: 52, 37, 82, 69, 98, 96, 33, 50, 88, and 90. Then compute the average simulated arrival rate.

|  |  |  |
| --- | --- | --- |
| Hour | Random number | Simulated arrival |
| 1 | 52 | 1 |
| 2 | 37 | 1 |
| 3 | 82 | 3 |
| 4 | 69 | 2 |
| 5 | 98 | 4 |
| 6 | 96 | 4 |
| 7 | 33 | 0 |
| 8 | 50 | 1 |
| 9 | 88 | 3 |
| 10 | 90 | 3 |
|  | Total | 17 |

Average arrival= 17/10 = 1.7