QM Refer Final

ID: 00010023

**Question 1.**

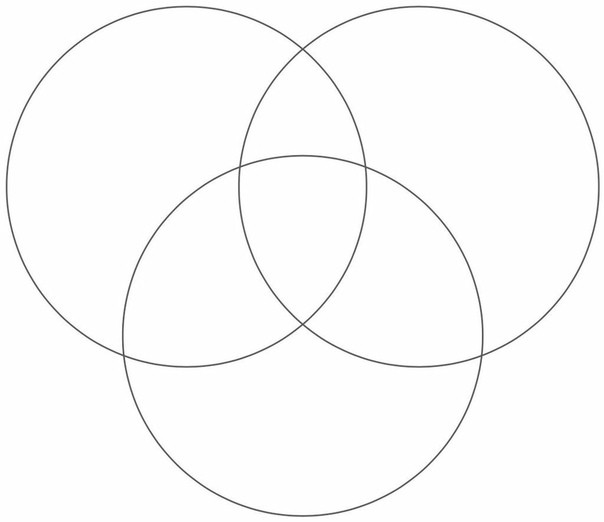
If the die is 4-sided, then probability that we get 1 when the dies tossed equals to ¼, or 25%.

If the die is 6-sided and we need 5 or 6 to drop, then probability of appearing 5 would be 1/6 and of 6 would be 1/6 too. So, the probability of getting 5 or 6 would 1/6+1/6, or 1/3.

Out of 52 cards, 4 are Queen and 4 are King. So, probability of getting a Queen is 4/52, while for King this is 4/52 too. So, probability of getting either King or Queen equals to 4/52+4/52, or 8/52.

Now, when probability of each event is found, we need to find probability of all these events occurring at the same time. To do this, we need to multiply all of them:

Probability is 73,72%



**Question 2.**

B

A

D=30

x

40-x-5

40-x-10

10

5

5

0

C

The whole probability should equal to 1; hence,

30+5+10+5+40-x-10+40-x-5+x=100

x=15. So,

**Question 3.**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Year | Quarter | Actual trend | 4AM | CMA | Diviation a.m. | Diviation m.m |
|
| 2016 | 1 | 44527 |  |  |  |  |
|  |
| 2 | 46485 |  |  |  |
| 46210 |
| 3 | 46293 | 23105 | 23188 | 2,00 |
| 47259 |
| 4 | 47535 | 23629,5 | 23905,5 | 2,01 |
| 48151 |
| 2017 | 1 | 48723 | 24075,5 | 24647,5 | 2,02 |
| 49158,25 |
| 2 | 50053 | 24579,13 | 25473,88 | 2,04 |
| 50289,75 |
| 3 | 50322 | 25144,88 | 25177,13 | 2,00 |
| 51906 |
| 4 | 52061 | 25953 | 26108 | 2,01 |
| 53414,25 |
| 2018 | 1 | 55188 | 26707,13 | 28480,88 | 2,07 |
| 54972,75 |
| 2 | 56086 | 27486,38 | 28599,63 | 2,04 |
| 56561,75 |
| 3 | 56556 | 28280,88 | 28275,13 | 2,00 |
| 57841,75 |
| 4 | 58417 | 28920,88 | 29496,13 | 2,02 |
| 58969 |
| 2019 | 1 | 60308 | 29484,5 | 30823,5 | 2,05 |
| 59917,75 |
| 2 | 60595 | 29958,88 | 30636,13 | 2,02 |
| 60538,75 |
| 3 | 60351 | 30269,38 | 30081,63 | 1,99 |
| 61567 |
| 4 | 60901 |  |  |  |
|  |
| 2020 | 1 | 64421 |  |  |  |
|  |
| 2 |  |  |  |  |
|  |
| 3 |  |  |  |  |
|  |
| 4 |  |  |  |  |
|  |

Th above table shows how I found the 4AM and CMA, deviation for additive model (a.m) and deviation for multiplicative model (m.m.)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Additive model | | | | | | | | | |
|
|  | 1 | | 2 | | 3 | | | 4 | |
| 2016 |  | |  | | 23188 | | | 23905,5 | |
| 2017 | 24647,5 | | 25473,88 | | 25177,13 | | | 26108 | |
| 2018 | 28480,88 | | 28599,63 | | 28275,13 | | | 29496,13 | |
| 2019 | 30823,5 | | 30636,13 | | 30081,63 | | |  | |
| 2020 |  | |  | |  | | |  | |
| Total | 83951,88 | | 84709,64 | | 106721,9 | | | 79509,63 | |
| Average | 27983,96 | | 28236,55 | | 26680,47 | | | 26503,21 | |
| Adjustment | 27351,05 | | 27351,05 | | 27351,05 | | | 27351,05 | |
| **Seasonal variation** | 632,91 | | 885,50 | | -670,58 | | | -847,84 | |
| Multiplicative model | | | | | | | | |
|
|  | | 1 | | 2 | | 3 | 4 | |
| 2016 | |  | |  | | 2 | 2,01 | |
| 2017 | | 2,02 | | 2,04 | | 2 | 2,01 | |
| 2018 | | 2,07 | | 2,04 | | 2 | 2,02 | |
| 2019 | | 2,05 | | 2,02 | | 1,99 |  | |
| 2020 | |  | |  | |  |  | |
| Total | | 6,14 | | 6,1 | | 7,99 | 6,04 | |
| Average | | 2,05 | | 2,03 | | 2,00 | 2,01 | |
| Adjustment | | 2,02 | | 2,02 | | 2,02 | 2,02 | |
| **Seasonal variation** | | 4,14 | | 4,11 | | 4,04 | 4,07 | |

The two above tables illustrate seasonal variation using two methods. (all calculations were done using formulas in Excel).

**Question 4.**

I think that the additive model would suit better to this example. This is because when I constructed a graph based on given data, I received the following:

As it can be seen, the trend is only upwards, with no dramatic falls during the period of 17 quarters. That is why, I think that additive model is the most appropriate one. When we try to forecast the future indices, seasonal variation that we got by using multiplicative model would give minor changes, due to very small numbers (4,14; 4,11). In our case, the numbers are in thousands, which means that variation of 4 would have almost no effect. However, in additive model, seasonal variation amounted to roughly 600 and 800, which can be noticeable on the graph if we construct it. That is why, additive model would give us more true indicators about the future.

Words count:145.

**Question 5.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Chain base index | | | | | |
|
|  | 2016 | 2017 | 2018 | 2019 | 2020 |
| 1 quarter | 44527 | 48723 | 55188 | 60308 | 64421 |
|  | 100 | 109,4 | 113,3 | 109,3 | 106,8 |
| 2 quarter | 46485 | 50053 | 56086 | 60595 |  |
|  | 100 | 107,7 | 112,1 | 108,0 |  |
| 3 quarter | 46293 | 50322 | 56556 | 60351 |  |
|  | 100 | 108,7 | 112,4 | 106,7 |  |
| 4 quarter | 47535 | 52061 | 58417 | 60901 |  |
|  | 100 | 109,5 | 112,2 | 104,3 |  |

Formula for chain base index:

Example:

Using the above formulae, chain base index was calculated for each year.

**Question 6.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Chain base index | | | | | |
|
|  | 2016 | 2017 | 2018 | 2019 | 2020 |
| 1 quarter | 4488764 | 4649728 | 4917129 | 5148400 | 5261548 |
|  | 100 | 103,6 | 105,8 | 104,7 | 102,2 |
| 2 quarter | 4678299 | 4863682 | 5141726 | 5360917 |  |
|  | 100 | 104,0 | 105,7 | 104,3 |  |
| 3 quarter | 4734573 | 4940866 | 5209973 | 5404652 |  |
|  | 100 | 104,4 | 105,4 | 103,7 |  |
| 4 quarter | 4813405 | 5065149 | 5311394 | 5517583 |  |
|  | 100 | 105,2 | 104,9 | 103,9 |  |

Formula for chain base index:

Example of above calculation:

Using the above formulae, chain base index was calculated for each year.

**Question 7.**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Year | Quarter | x | y | x\*y | x^2 | y^2 |
|
| 2016 | 1 | 44527 | 4488764 | 1,99871E+11 | 1982653729 | 2,0149E+13 |
|
| 2 | 46485 | 4678299 | 2,17471E+11 | 2160855225 | 2,18865E+13 |
|
| 3 | 46293 | 4734573 | 2,19178E+11 | 2143041849 | 2,24162E+13 |
|
| 4 | 47535 | 4813405 | 2,28805E+11 | 2259576225 | 2,31689E+13 |
|
| 2017 | 1 | 48723 | 4649728 | 2,26549E+11 | 2373930729 | 2,162E+13 |
|
| 2 | 50053 | 4863682 | 2,43442E+11 | 2505302809 | 2,36554E+13 |
|
| 3 | 50322 | 4940866 | 2,48634E+11 | 2532303684 | 2,44122E+13 |
|
| 4 | 52061 | 5065149 | 2,63697E+11 | 2710347721 | 2,56557E+13 |
|
| 2018 | 1 | 55188 | 4917129 | 2,71367E+11 | 3045715344 | 2,41782E+13 |
|
| 2 | 56086 | 5141726 | 2,88379E+11 | 3145639396 | 2,64373E+13 |
|
| 3 | 56556 | 5209973 | 2,94655E+11 | 3198581136 | 2,71438E+13 |
|
| 4 | 58417 | 5311394 | 3,10276E+11 | 3412545889 | 2,82109E+13 |
|
| 2019 | 1 | 60308 | 5148400 | 3,1049E+11 | 3637054864 | 2,6506E+13 |
|
| 2 | 60595 | 5360917 | 3,24845E+11 | 3671754025 | 2,87394E+13 |
|
| 3 | 60351 | 5404652 | 3,26176E+11 | 3642243201 | 2,92103E+13 |
|
| 4 | 60901 | 5517583 | 3,36026E+11 | 3708931801 | 3,04437E+13 |
|
| 2020 | 1 | 64421 | 5261548 | 3,38954E+11 | 4150065241 | 2,76839E+13 |
|
| 2 |  |  |  |  |  |
|
| 3 |  |  |  |  |  |
|
| 4 |  |  |  |  |  |
|
| Total |  | 918822 | 85507788 | 4,64881E+12 | 50280542868 | 4,31517E+14 |
|

The table was constructed by using Excel 2019 application by Microsoft. Because the numbers were very huge, I could not calculate them by using simple calculator.

Correlation formula:

- Correlation between two variables

- Covariance of x and y

- standard deviation of x

- standard deviation of y

Another formula is:

Using this formula and above table, I found the correlation which equaled to approximately 91,75%, or 92%.

**Question 8.**

After some calculations, I found that correlation between quarterly financial statements of United Health and quarterly GDP rates in the USA equals to 92%. In this case, correlation is positive and strong, because the percentage is close to 100%. This means that an increase in the financial statement of United Health was accompanied by an increase in the GDP of the USA. This indicates that two variables have a positive correlation.

**Question 9.**

A=

B=

C=

= =

=

=

=

**Question 10.**

In this scenario, it is better to use median. Firstly, it was mentioned that few participants had extremely high income in comparison to others. This shows that indexes are not close to each other. So, it would be illogical to assume that mean is appropriate. If mean is implemented, then difference between the mean and those with low income would be huge, due to high salaries of few people. Similarly, the mean would be far less than the actual salary of the same “few people”. That is why, it is better to use median, as well as upper and lower quartile if appropriate. By doing this, we take into consideration this huge gap and give relatively fair view of the income. Hence, this medium would be close to the income of students and unemployed people, which was 0. At the same time, it would not exaggerate the actual income level because of very “few people”. This is my opinion about the situation.

Word count: 162