**Session 11: Additional Exercise**

**The marks awarded for an assignment set for a Year 8 class of 20 students were as follows:**

**6 7 5 7 7 8 7 6 9 7 4 10 6 8 8 9 5 6 4 8**

**Calculate the mean, median, mode and standard deviation.**

**Solution:**

1. **Mean:**

Mean = (Σ xi ) / n

xi = Each value in the data set

n = Total number of values in the data set

Σ of xi = 6+7+5+7+7+8+7+6+9+7+4+10+6+8+8+9+5+6+4+8 = 6.85

20

**The Mean of the given data is 6.85**

1. **Median:**

The **Median** is the "middle" of a sorted list of numbers

|  |  |
| --- | --- |
| **Slno** | **Data** |
| 1 | 4 |
| 2 | 4 |
| 3 | 5 |
| 4 | 5 |
| 5 | 6 |
| 6 | 6 |
| 7 | 6 |
| 8 | 6 |
| 9 | 7 |
| 10 | 7 |
| 11 | 7 |
| 12 | 7 |
| 13 | 7 |
| 14 | 8 |
| 15 | 8 |
| 16 | 8 |
| 17 | 8 |
| 18 | 9 |
| 19 | 9 |
| 20 | 10 |

**Median of the given data set = Sum of middle values / 2**

**=( 7 + 7 ) / 2 = 6.5**

1. **Mode:**

Mode of the data is the most repeated value in the data set.

Hence, Mode of the given data set = 7 (most repeated value)

1. **Standard Deviation:**

**SD = √∑(x-)2**

**n**

**Where :**

SD = Standard Deviation

https://lh3.googleusercontent.com/2HoE3bnlU1bMTeEjZuCn0Ep2od-gVpwj3hd9ndMQ0CbdtGScytqmxbvQyHsH-65UoB2CVcA-1-avlcUHh3nM4_ZPq7eS6TyIHFXJv4d5peHaGb6vL8Qql9Dx487LlSZV8sPVcTSU = each value in the data set

https://lh6.googleusercontent.com/spMH8lBlE0tvB3VH5UG6G-U3P9TU1wpO90oCXBR49EeTCx4s2JN21JmHiGnZMfKBgpC6-tXnpW4AfWjB_lUGBrCsj1QlJObjCKgy8uj3YSgZvCEPNTYldiMZ29IfPGZAAnGi9EWW = Mean is the data set

n = number of values in the data set

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| |  | | --- | | https://lh3.googleusercontent.com/2HoE3bnlU1bMTeEjZuCn0Ep2od-gVpwj3hd9ndMQ0CbdtGScytqmxbvQyHsH-65UoB2CVcA-1-avlcUHh3nM4_ZPq7eS6TyIHFXJv4d5peHaGb6vL8Qql9Dx487LlSZV8sPVcTSU | | |  | | --- | | https://lh6.googleusercontent.com/spMH8lBlE0tvB3VH5UG6G-U3P9TU1wpO90oCXBR49EeTCx4s2JN21JmHiGnZMfKBgpC6-tXnpW4AfWjB_lUGBrCsj1QlJObjCKgy8uj3YSgZvCEPNTYldiMZ29IfPGZAAnGi9EWW | | |  | | --- | | https://lh6.googleusercontent.com/spMH8lBlE0tvB3VH5UG6G-U3P9TU1wpO90oCXBR49EeTCx4s2JN21JmHiGnZMfKBgpC6-tXnpW4AfWjB_lUGBrCsj1QlJObjCKgy8uj3YSgZvCEPNTYldiMZ29IfPGZAAnGi9EWWhttps://lh3.googleusercontent.com/2HoE3bnlU1bMTeEjZuCn0Ep2od-gVpwj3hd9ndMQ0CbdtGScytqmxbvQyHsH-65UoB2CVcA-1-avlcUHh3nM4_ZPq7eS6TyIHFXJv4d5peHaGb6vL8Qql9Dx487LlSZV8sPVcTSU**-** | | Image result for standard deviation formula   |  | | --- | |  | |
| 4 | 6.85 | 2.85 | 8.1225 |
| 4 | 6.85 | 2.85 | 8.1225 |
| 5 | 6.85 | 1.85 | 3.4225 |
| 5 | 6.85 | 1.85 | 3.4225 |
| 6 | 6.85 | 0.85 | 0.7225 |
| 6 | 6.85 | 0.85 | 0.7225 |
| 6 | 6.85 | 0.85 | 0.7225 |
| 6 | 6.85 | 0.85 | 0.7225 |
| 7 | 6.85 | -0.15 | 0.0225 |
| 7 | 6.85 | -0.15 | 0.0225 |
| 7 | 6.85 | -0.15 | 0.0225 |
| 7 | 6.85 | -0.15 | 0.0225 |
| 7 | 6.85 | -0.15 | 0.0225 |
| 8 | 6.85 | -1.15 | 1.3225 |
| 8 | 6.85 | -1.15 | 1.3225 |
| 8 | 6.85 | -1.15 | 1.3225 |
| 8 | 6.85 | -1.15 | 1.3225 |
| 9 | 6.85 | -2.15 | 4.6225 |
| 9 | 6.85 | -2.15 | 4.6225 |
| 10 | 6.85 | -3.15 | 9.9225 |
|  |  | Image result for standard deviation formula | 50.55 |

**∴Standard Deviation = 50.55 /20 = √2.5275 = 1.5898**

**Problem Statement 2 :**

The number of calls from motorists per day for roadside service was recorded for a particular month:

28, 122, 217, 130, 120, 86, 80, 90, 140, 120, 70, 40, 145, 113, 90, 68, 174, 194, 170, 100, 75, 104, 97, 75,123, 100, 75, 104, 97, 75, 123, 100, 89, 120, 109

**Calculate the mean, median, mode and standard deviation**

**Solution:**

1. **Mean:**

Mean = (Σ xi ) / n

xi = Each value in the data set

n = Total number of values in the data set

**∑xi = 3763**

**n = 35**

**∴ 3763 / 35 = 107. 51**

1. **Median:**

{(n + 1) ÷ 2}th element

n = 35

∴ n+1 = 35+1 = 36

∴ {(n + 1) ÷ 2}th element = 36/ 2 = 18 = 100 from the below table

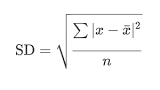
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| --- | --- | --- |
| Sl. No. | https://lh3.googleusercontent.com/2HoE3bnlU1bMTeEjZuCn0Ep2od-gVpwj3hd9ndMQ0CbdtGScytqmxbvQyHsH-65UoB2CVcA-1-avlcUHh3nM4_ZPq7eS6TyIHFXJv4d5peHaGb6vL8Qql9Dx487LlSZV8sPVcTSU   |  | | --- | |  | |
| 1 | 28 |
| 2 | 40 |
| 3 | 68 |
| 4 | 70 |
| 5 | 75 |
| 6 | 75 |
| 7 | 75 |
| 8 | 75 |
| 9 | 80 |
| 10 | 86 |
| 11 | 89 |
| 12 | 90 |
| 13 | 90 |
| 14 | 97 |
| 15 | 97 |
| 16 | 100 |
| 17 | 100 |
| 18 | 100 |
| 19 | 104 |
| 20 | 104 |
| 21 | 109 |
| 22 | 113 |
| 23 | 120 |
| 24 | 120 |
| 25 | 120 |
| 26 | 122 |
| 27 | 123 |
| 28 | 123 |
| 29 | 130 |
| 30 | 140 |
| 31 | 145 |
| 32 | 170 |
| 33 | 174 |
| 34 | 194 |
| 35 | 217 |

1. **Mode:**

Mode of the data is the most repeated value in the data set.

∴ Mode of the given data set = 75 (most repeated value)

1. **Standard Deviation:**

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**Where :**

SD = Standard Deviation

https://lh3.googleusercontent.com/2HoE3bnlU1bMTeEjZuCn0Ep2od-gVpwj3hd9ndMQ0CbdtGScytqmxbvQyHsH-65UoB2CVcA-1-avlcUHh3nM4_ZPq7eS6TyIHFXJv4d5peHaGb6vL8Qql9Dx487LlSZV8sPVcTSU = each value in the data set

https://lh6.googleusercontent.com/spMH8lBlE0tvB3VH5UG6G-U3P9TU1wpO90oCXBR49EeTCx4s2JN21JmHiGnZMfKBgpC6-tXnpW4AfWjB_lUGBrCsj1QlJObjCKgy8uj3YSgZvCEPNTYldiMZ29IfPGZAAnGi9EWW = Mean is the data set

n = number of values in the data set

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sl. No.** | https://lh3.googleusercontent.com/2HoE3bnlU1bMTeEjZuCn0Ep2od-gVpwj3hd9ndMQ0CbdtGScytqmxbvQyHsH-65UoB2CVcA-1-avlcUHh3nM4_ZPq7eS6TyIHFXJv4d5peHaGb6vL8Qql9Dx487LlSZV8sPVcTSU   |  | | --- | |  | | https://lh6.googleusercontent.com/spMH8lBlE0tvB3VH5UG6G-U3P9TU1wpO90oCXBR49EeTCx4s2JN21JmHiGnZMfKBgpC6-tXnpW4AfWjB_lUGBrCsj1QlJObjCKgy8uj3YSgZvCEPNTYldiMZ29IfPGZAAnGi9EWW   |  | | --- | |  | | https://lh3.googleusercontent.com/2HoE3bnlU1bMTeEjZuCn0Ep2od-gVpwj3hd9ndMQ0CbdtGScytqmxbvQyHsH-65UoB2CVcA-1-avlcUHh3nM4_ZPq7eS6TyIHFXJv4d5peHaGb6vL8Qql9Dx487LlSZV8sPVcTSUhttps://lh6.googleusercontent.com/spMH8lBlE0tvB3VH5UG6G-U3P9TU1wpO90oCXBR49EeTCx4s2JN21JmHiGnZMfKBgpC6-tXnpW4AfWjB_lUGBrCsj1QlJObjCKgy8uj3YSgZvCEPNTYldiMZ29IfPGZAAnGi9EWW   |  | | --- | | - | | Image result for standard deviation formula   |  | | --- | |  | |
| 1 | 28 | 100 | -72 | 5184 |
| 2 | 40 | 100 | -60 | 3600 |
| 3 | 68 | 100 | -32 | 1024 |
| 4 | 70 | 100 | -30 | 900 |
| 5 | 75 | 100 | -25 | 625 |
| 6 | 75 | 100 | -25 | 625 |
| 7 | 75 | 100 | -25 | 625 |
| 8 | 75 | 100 | -25 | 625 |
| 9 | 80 | 100 | -20 | 400 |
| 10 | 86 | 100 | -14 | 196 |
| 11 | 89 | 100 | -11 | 121 |
| 12 | 90 | 100 | -10 | 100 |
| 13 | 90 | 100 | -10 | 100 |
| 14 | 97 | 100 | -3 | 9 |
| 15 | 97 | 100 | -3 | 9 |
| 16 | 100 | 100 | 0 | 0 |
| 17 | 100 | 100 | 0 | 0 |
| 18 | 100 | 100 | 0 | 0 |
| 19 | 104 | 100 | 4 | 16 |
| 20 | 104 | 100 | 4 | 16 |
| 21 | 109 | 100 | 9 | 81 |
| 22 | 113 | 100 | 13 | 169 |
| 23 | 120 | 100 | 20 | 400 |
| 24 | 120 | 100 | 20 | 400 |
| 25 | 120 | 100 | 20 | 400 |
| 26 | 122 | 100 | 22 | 484 |
| 27 | 123 | 100 | 23 | 529 |
| 28 | 123 | 100 | 23 | 529 |
| 29 | 130 | 100 | 30 | 900 |
| 30 | 140 | 100 | 40 | 1600 |
| 31 | 145 | 100 | 45 | 2025 |
| 32 | 170 | 100 | 70 | 4900 |
| 33 | 174 | 100 | 74 | 5476 |
| 34 | 194 | 100 | 94 | 8836 |
| 35 | 217 | 100 | 117 | 13689 |
|  |  |  | Image result for standard deviation formula   |  | | --- | |  | | 54593 |

**Standard Deviation = 54593 /35 = √1559.8 = 39.4943**

**Problem Statement 3:**

The number of times I go to the gym in weekdays, are given below along with its associated probability:

x = 0, 1, 2, 3, 4, 5

f(x) = 0.09, 0.15, 0.40, 0.25, 0.10, 0.01

Calculate the mean no. of workouts in a week. Also evaluate the variance involved in it.

**Solution:**

**Expected Mean of the Work outs:**

Let us call x asNo. of Work outs in a week

P(x) is given as - f(x) = 0.09, 0.15, 0.40, 0.25, 0.10, 0.01

Calculation of Expected mean number of workouts in a week = Weighted average of the workouts and the probability.

i.e., Expected mean of work outs (E) = E(x) :

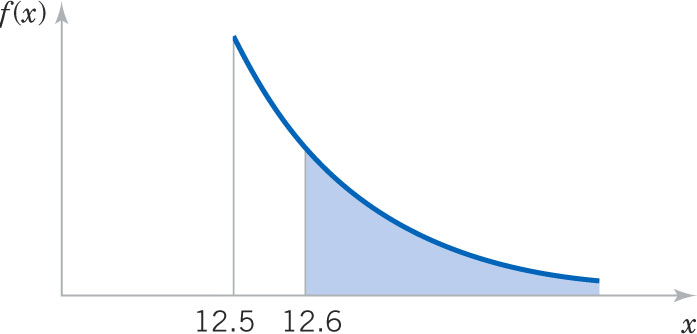
|  |  |  |
| --- | --- | --- |
| x | Probability f(x) | Weighted sum of probability |
| 0 | 0.09 | 0.00 |
| 1 | 0.15 | 0.15 |
| 2 | 0.40 | 0.80 |
| 3 | 0.25 | 0.75 |
| 4 | 0.10 | 0.40 |
| 5 | 0.01 | 0.05 |
| **Mean work out E(x)** | | **2.15** |

**Variance:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| x | Probability f(x) | Weighted sum of probability | x- | x | xp(x) |
| 0 | 0.09 | 0.00 | -2.15 | 4.6225 | 0.416025 |
| 1 | 0.15 | 0.15 | -1.15 | 1.3225 | 0.198375 |
| 2 | 0.40 | 0.80 | -0.15 | 0.0225 | 0.009 |
| 3 | 0.25 | 0.75 | 0.85 | 0.7225 | 0.180625 |
| 4 | 0.10 | 0.40 | 1.85 | 3.4225 | 0.34225 |
| 5 | 0.01 | 0.05 | 2.85 | 8.1225 | 0.081225 |
| Mean work out | | 2.15 |  |  | 1.2275 |
| Variance value | | | | | 1.10792599 |

Problem Statement 4: [100 marks]

Let the continuous random variable D denote the diameter of the hole drilled in an aluminum sheet. The target diameter to be achieved is 12.5mm. Random disturbances in the process often result in inaccuracy. Historical data shows that the distribution of D can be modelled by the PDF f(d) = 20e−20(d−12.5), d ≥12.5. If a part with diameter > 12.6 mm needs to be scrapped, what is the proportion of those parts? What is the CDF when the diameter is of 11 mm? What is your conclusion regarding the proportion of scraps?



P(x>12.6) = integral (20e(power of -20−20(d−12.5))dx = 0.135