Introduction to Random Variables and Probability Distribution

Example 1:

Dr. Fidgit developed a test to measure boredom tolerance. He administered it to the group of 20,000 adults between the ages of 25 and 35. The possible scores were 0, 1, 2, 3, 4, 5, and 6, with 6 for the highest tolerance for boredom.

Here are the results:

Score, x	Number of subjects
0	1400
1	2600
2	3600
3	6000
4	4400
5	1600
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-we have 20,000 adults total. Out of them 6000 got score 3.
Thus, we'll use *relative frequency* to find the probability:

P(3)= $\left(\frac{6000}{20000}\right)=\frac{6}{20}=0.3$

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Score, x	Number of subjects	Probability P(x)
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Σ P(x) = P(0) + P(1) + P(2 + P(3) + P(4) + P(5) + P(6) = 0.07 + 0.13 + 0.18 + 0.30 + 0.22 + 0.08 + 0.02= 1

Yes, they do add up to 1.

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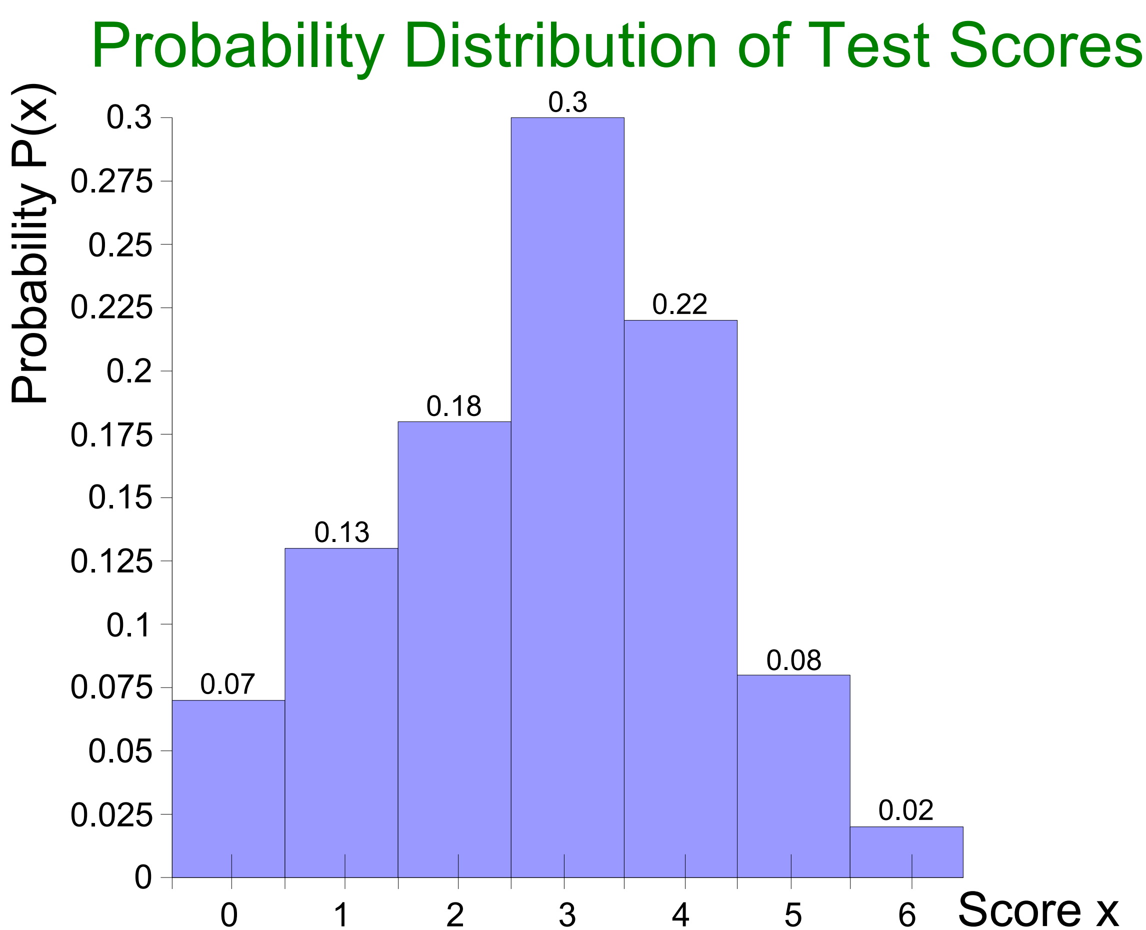

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(e) A company needs to hire someone with a score on the boredom tolerance test of 5 or 6 to operate the fabric press machine. Find the probability that a person chosen at random from the group who took the test made either 5 or 6.

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(e) A company needs to hire someone with a score on the boredom tolerance test of 5 or 6 to operate the fabric press machine. Find the probability that a person chosen at random from the group who took the test made either 5 or 6.

The events are mutually exclusive, thus we will use formula P(A or B) = P(A) + P(B)

P(5 or 6) = P(5)+P(6)=0.08+0.02=0.1 or 10%

So one out of ten people who took the test would qualify for the position.

Example 2 (p. 214/5): ***Marketing: income***
What is the income distribution of super shoppers? In the following table, income units are in thousands of dollars, and each interval goes up to but doesn't include the given high value. The midpoints are given to the nearest thousand dollars.

Income range	5-15	15-25	25-35	35-45	45-55	55 or more
Midpoint x	10	20	30	40	50	60
Percent of super shoppers	21%	14%	22%	15%	20%	8%

(a) Do we have a valid probability distribution (using the midpoints and the percentages)?

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(a) Do we have a valid probability distribution (using the midpoints and the percentages)?

Yes we do, because
$P(10)+P(20)+P(30)+P(40)+P(50)+P(60)=0.21+0.14+0.22+0.15+0.2+0.08=1$

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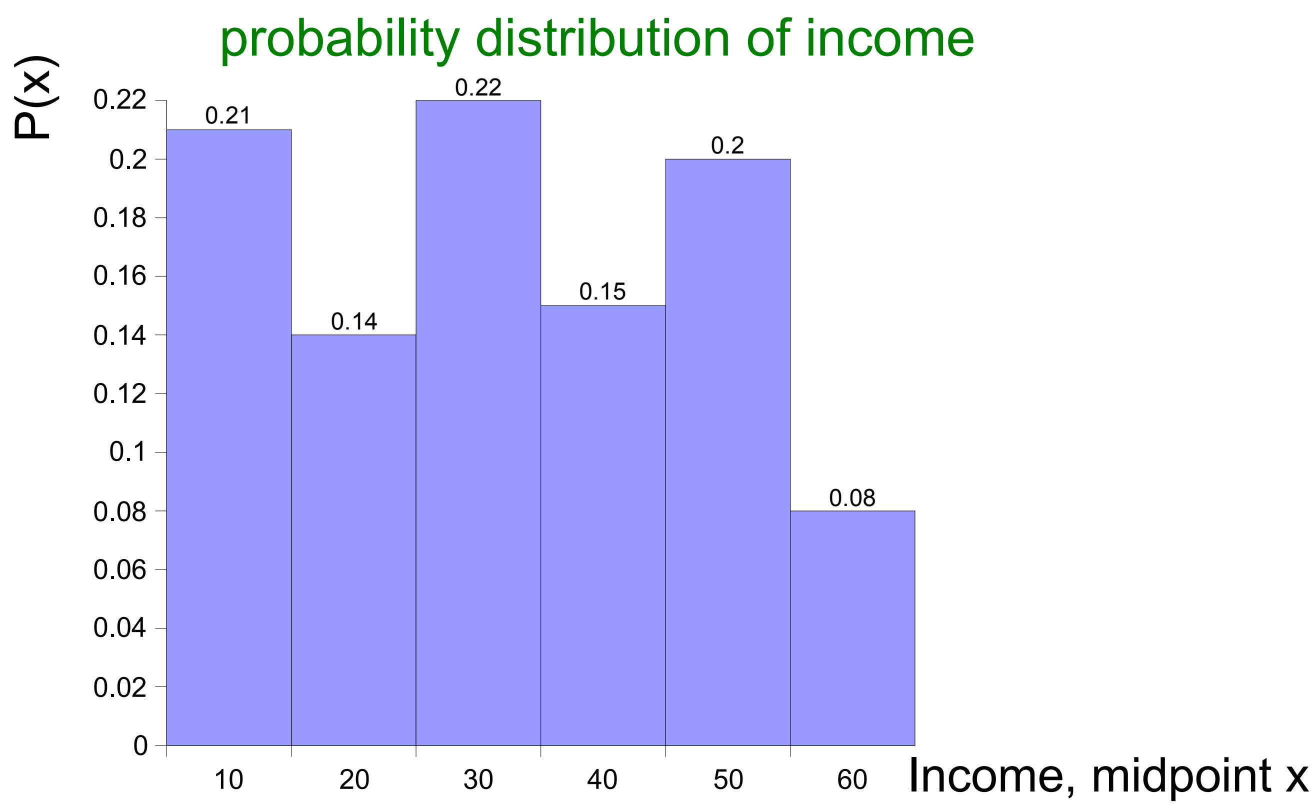

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(c) Compute the expected income μ of a super shopper

Midpoint x	Percent of super shoppers	xP(x)
10	0.21	2.10
20	0.14	2.80
30	0.22	6.60
40	0.15	6.00
50	0.2	10.00
60	0.08	4.80
		ΣxP(x)= 32.3

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What is the income distribution of super shoppers? In the following table, income units are in thousands of dollars, and each interval goes up to but doesn't include the given high value. The midpoints are given to the nearest thousand dollars.

(d) Compute the standard deviation σ for the income of the super shoppers

Midpoint x	Percent of super shoppers	xP(x)	X-μ	$(x-\mu)^2$	$(x-\mu)^2P(x)$
10	0.21	2.10	-22.3	497.29	104.43
20	0.14	2.80	-12.3	151.29	21.18
30	0.22	6.60	-2.3	5.29	1.16
40	0.15	6.00	7.7	59.29	8.89
50	0.2	10.00	17.7	313.29	62.66
60	0.08	4.80	27.7	767.29	61.38
		ΣxP(x)= 32.3			259.71

$$\sigma = \sqrt{259.71} \approx 16.12$$