

Answers using TI 83:

A multiple choice test has 10 questions. Each question has four answer choices. What is the probability that a student, choosing answers at random:

1a. Gets 7 questions correct (exactly 7)?

Number of trials is $n=10$, probability of success is $p=1/4 = 0.25$

Proceed: 2nd VARS (DISTR)



Select `binompdf(10, 1/4, 7)` # comment: the format is (n, p, x)

```
binompdf
trials:10
p:1/4
x value:7
Paste
```

Hit enter twice:

```
binompdf(10,1/4,7)
.....0030899048
```

1b. Has at least one question correct?

At last one correct = $1 - P$ no correct (zero correct)

Type 1 – then repeat steps for 1a:

1- binompdf(10, 1/4, 0)

```
binompdf
trials:10
p:1/4
x value:0
Paste
```

Again, hit enter twice:

```
1-binompdf(10,1/4,0)
.....9436864853
```

1c. Has at least 3 questions correct?

P at least 3 questions correct = $1 - [P(0)+P(1)+P(2)]$

In this case, we use binomial cdf, which is the “cumulative” value from zero up to a given X, in this case 2.

```
1-binomcdf(10,1/4,2)
.....474407196
```

1d. Has at most 1 question correct?

“At most” means from zero to a number x , in this case 1. Therefore, we use binomial cdf:

```
binomcdf(10,1/4,1)
.....2440252304
```

1e. Has at most 4 questions correct?

Same as 1d, just set $x = 4$.

```
binomcdf(10,1/4,4)
.....9218730926
```

1f. Has all questions correct?

For all questions correct, set $x = 10$. That is 10 out of 10 correct, binomial pdf:

```
binompdf(10,1/4,10)
.....9.536743164E-7
```

The output in scientific notation is $9.536743164 \times 10^{-7}$ as a decimal: 0.0000009536743164

1g. Has all questions wrong?

All questions wrong means zero correct. Binomial pdf:

```
binompdf(10,1/4,0)
.....0563135147
```

1h. What is the mean number of correct questions the student may expect?

Means of the binomial distribution

$$\mu = n \cdot p = 10 \cdot \frac{1}{4} = 2.5$$

1i. What is the standard deviation of the variable *number of questions correct*?

$$\sigma = \sqrt{n \cdot p \cdot q} = \sqrt{10 \cdot \frac{1}{4} \cdot \frac{3}{4}} = 1.37$$

Note: $q = 1 - p = 1 - \frac{1}{4} = \frac{3}{4}$.

1j. What is the minimum and maximum usual values of correct questions the student may expect?

The minimum usual value is given by $\mu - 2\sigma$: $2.50 - 2(1.37) = -0.24$

The interpretation of this result: if someone answer 10 questions at random, with a probability of $\frac{1}{4}$ of being correct on each instance, it will be “usual” getting all questions wrong (zero correct). The value -0.24 doesn’t have a physical meaning, since no one can go lower of zero correct.

The maximum usual value is given by $\mu + 2\sigma$: $2.50 + 2(1.37) = 2.5 + 2 \cdot 1.37 = 5.24$ So the test taker may expect up to 5 questions correct. Anything above that result will be “unusual” or exceptionally high.

1k. May we consider 6 as a usual number of correct questions under the conditions of this experiment?

Six questions correct would be an unusual high number of correct answers under the conditions of this experiment.