11. A disease test is advertised as being 91% accurate. If you have the disease you will test positive 99% of the time, and if you don’t have the disease you will test negative 99% of the time. If 1% of all people have this disease and you feel positive, what is the probability that you actually have disease?

(a) 2/3 (b) 1/3

(c) 1/2 (d) 1/4

Solution:

Let D be the event having disease + be the event that the testing positive.

Let D be the event not having disease.

We need to find

P(D/+) = P(D ∩ +)

P(+)

= P(D)∙P(+/T)

P(D)P(+/T)+P(D)P(+/D)

= 1%∙99%

1%∙99%+99%∙1%

= 99/100

99/100+99/100

= 12

= 0.5

12. Emma’s coin box contains 8 fair, standard coins (head and tails) and 1 coin which has head on both sides. He selects a coin randomly and flips it 4 times, getting all heads. If he flips the coin again, what is the probability it will be heads?

(a) 1/6 (b) 1/3

(c) 5/6 (d) 2/3

Solution:

Let F and H4 be the events of having the fair coin and flipping 4 heads respectively.

Let F be the event having unfair coin.

P( H5) = P(F/ H4)P(H/F) + P(F/ H4)P(H/F )

We need to find, P(F/ H4) and P(F/ H4)

P(F/ H4) = 1 − P(F/ H4)

P(F/ H4) = P(F P(H∩ 4H)

4)

= P(H4/F)∙P(F)+P(HP(H4/F)∙P(F)

4/F)∙P(F)

=

161×16189+1××89 19

= 13 ∴ P(F/H4) = 23 P(H5) = 13 × 12 + 23 × 1 = 56

13. In general, the probability that it rains on Saturday is 25%. If it rains on Saturday the probability that it rains on Sunday is 50%. If it doesn’t rain on Saturday, the probability that it rains on Sunday is 25%.

Given that it rained on Sunday, what is the probability that it rained on Saturday?

(a) 40% (b) 35%

(c) 60% (d) 35.7%

Solution:

Is is given that

P(Su ⁄ Sa ) = 50%

and P(Su ⁄ Sa ) = 25%

Is is given that

P(Sa) = 25%

∴ P(Sa) = 75%

We need to find

P(Su ⁄ Sa ) = P(Sa P(Su)

∩ Su)

= P(Sa)P(Su/Sa)+P(Sa)P(Sa/Sa)

P(Sa) P(Su/Sa)

= 25%×50%+75%×25%

25%×50%

= 40%

14. 1% of people have a rare cancer and there is a test of this cancer which is “90% accurate” that is If you have the cancer there is a 90% chance the test will be positive. If you don’t have the cancer there is a 90% chance the test will be negative.

If you take the test and positive, what is the approximate probability that you have the cancer?

(a) 10% (b) 90%

(c) 50% (d) None of these

Solution:

We need to find

P(C +⁄ ) = P(C P(+)

∩ +)

= P(C)P(+ P(C)P(+ C⁄ )+P(C)P(+ C⁄ )

C⁄ )

Given data

P(C) = 100 1P(+ C⁄ ) = 100 90

∴ P(C +⁄ ) =

1100 × 10 91100 × 10 9+ 100 99 × 10 1

= 9108

= 112

≈ 10%

15. A family has two children. Given that one of the children is a boy. What is the probability that both children are boys?

(a) 1/3 (b) 1/2

(c) 13/27 (d) 11/27

Solution:

There are 4 ways {bb, bg, gb, gg}

It is given that the family already has a boy.

∴ The probability of both children is 1/3.