15. Composition and Resolution of Concurrent Forces (composition-and-resolution-of-concurrent-forces/solution/grade-12/mathematics/190/solutions)

16. Parallel Forces, Moments and Couples (parallel-forces-moments-and-couples/solution/grade-12/mathematics/193/solutions)

17. Kinetics : The Geometry of Motion (kinetics-:-the-geometry-of-motion/solution/grade-12/mathematics/196/solutions)

18. Newton's Law of Motion (newtons-law-of-motion/solution/grade-12/mathematics/199/solutions)

19. Projectiles (projectiles/solution/grade-12/mathematics/202/solutions)

20. Work, Energy and Power (work-energy-and-power/solution/grade-12/mathematics/203/solutions)

21. Linear Programming (linear-programming/solution/grade-12/mathematics/206/solutions)

22. Computational Methods (computational-methods/solution/grade-12/mathematics/211/solutions)

23. System of Linear Equations (system-of-linear-equations/solution/grade-12/mathematics/209/solutions)

24. Numerical Integration (numerical-integration/solution/grade-12/mathematics/208/solutions)

Previous (probability/solution/grade-12/mathematics/188/solutions)

Next (composition-and-resolution-of-concurrent-forces/solution/grade-12/mathematics/190/solutions)

Probability

14.1 (probability-14-1/solution/grade-12/mathematics/188/solutions)

14.2 (probability-14-2/solution/grade-12/mathematics/189/solutions)

14.2

1.

Soln:

(i)

q = 0.50, n = 40.

p = 1 – n = 1 – 0.50 = 0.50.

Mean of the binomial distribution = np = 40 * 0.5 = 20.

Standard deviation = $\sqrt{npq}$ = $\sqrt{40*0.5*0.5}$ = 3.162.

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(ii)

q = 1 – p = 1 – 0.6 = 0.4

Mean = np = 50 * 0.6 = 30.

Standard deviation = $\sqrt{npq}$ = $\sqrt{50*0.6*0.4}$ = 3.464.

b.

Soln:

Mean = np = 24 …(I)

s.d. = $\sqrt{npq}$ = $\sqrt{3.2}$ ….(ii)

nqp = 3.2

From (i) and (ii),

Or, $\frac{3.2}{2.4} = \frac{npq}{np}$

So, q = 1.333 > 1 which is wrong as p + q = 1.

Hence, the results are wrong.

2.

Soln,

Mean = np = 80 …(I)

s.d. = $\sqrt{npq}$ = 8 ….(ii)

nqp = 64

or, $\frac{np}{npq} = \frac{80}{64}$.

Or, $\frac{1}{q} = \frac{5}{4}$

So, q = 0.8

p = 1 – q = 1 – 0.8 = 0.2

Hence, there is no inconsistency.

From (i), n * 0.2 = 80

So, n = $\frac{80}{0.2}$ = 400.

3.

Soln:

Mean = np = 12 …(I)

Variance = npq = 8 ….(ii)

Or, $\frac{np}{npq} = \frac{12}{8}$

Or, $\frac{1}{q} = \frac{3}{2}$

So, q = $\frac{2}{3}$.

p = 1 – q = 1 – $\frac{2}{3}$ = $\frac{1}{3}$

From (i), n * $\frac{1}{3}$ = 12.

So, n = 36.

So, the binomial distribution = $(q + n)^n$ = $\left(\frac{2}{3} + \frac{1}{3}\right)^{36}$.

4.

Soln:

Let, p = Probability of getting a 5 or 6 in throwing a die = $\frac{2}{6} = \frac{1}{3}$.

q = 1 – p = 1 – $\frac{1}{3} = \frac{2}{3}$

n = 3.

P(r) = Probability of r successes in n trial. = ${}^{n}C_{r}.p^{r}q^{n-r}$.

a. P(3) = Probability of 3 successes = ${}^{3}C_{3}p^{3}q^{3-3} = \frac{3!}{(3-3)!3!}.\left(\frac{1}{3}\right)^{3}.\left(\frac{2}{3}\right)^{0} = \frac{1}{27}$.

b. P(2) = Probability of 2 successes.

= ${}^{3}C_{2}.p^{2}.q^{3-2}$.

= $\frac{3!}{(3-2)!2!} = \left(\frac{1}{3}\right)^{2}.\left(\frac{2}{3}\right)^{1} = 3.\frac{1}{9}.\frac{2}{3} = \frac{2}{9}$.

5.

Soln:

Let p = Probability of getting even number throwing a dive = $\frac{3}{6} = \frac{1}{2}$.

q = 1 – p = 1 – $\frac{1}{2} = \frac{1}{2}$.

n = 4.

P(r) = Probability of r successes in n trials = ${}^{n}C_{r}.p^{r}.q^{n-r}$.

a. P(2) = Probability of 2 successes

= ${}^{4}C_{2}.p^{2}.q^{4-2}$. = $\frac{4!}{(4-2)!2!}.\left(\frac{1}{2}\right)^{2}.\left(\frac{1}{2}\right)^{2} = \frac{3}{8}$.

b. P(4) = Probability of 4 successes

= ${}^{4}C_{2}.p^{4}.q^{4-4} = 1.\left(\frac{1}{2}\right)^{4}.\left(\frac{1}{2}\right)^{0} = \frac{1}{16}$.

6.

Soln:

p = Prob. Of getting a head in one toss = ½

q = 1 – p = 1 – $\frac{1}{2}$ = ½

n = No. of tosses = 5.

r= No. of heads = 2.

P(r) = Prob. Of r successes in trial = ${}^{n}C_{r}.p^{r}.q^{n-r}$.

(i) P(2) = Prob. Of 2 heads in 5 tosses,

= ${}^{5}C_{2}.p^{2}.q^{3} = \frac{5.4}{2}.\left(\frac{1}{2}\right)^{2}\left(\frac{1}{2}\right)^{3} = 10 * \frac{1}{4} * \frac{1}{8} = \frac{5}{16}$.

(ii) P (4 ≥ 2) = P(2) + P(3) + P(4) + P(5)

= ${}^{2}C_{5}.p^{2}q^{3} + {}^{4}C_{3}p^{3}q^{2} + {}^{5}C_{4}p^{4}q + {}^{5}C_{5}p^{5}$

= $\frac{5.4}{2}\left(\frac{1}{2}\right)^{2}.\left(\frac{1}{2}\right)^{3} + \frac{5.4}{2}\left(\frac{1}{2}\right)^{3}\left(\frac{1}{2}\right)^{3} + 5\left(\frac{1}{2}\right)^{4}.\left(\frac{1}{2}\right) + 1.\left(\frac{1}{2}\right)^{5}$.

= $\left(\frac{1}{2}\right)^{5}$ [10 + 10 + 5 + 1]= $\frac{1}{32}$.26 = $\frac{13}{16}$.

7.

Soln:

p = Prob. Of two heads with two coins in one toss = 1/4 .

q = 1 – p = 1 – $\frac{1}{4}$ = $\frac{3}{4}$.

n= no. of tosses = 4.

P(2) = $^4C_2.p^2q^2 = \frac{4.3}{2}\left(\frac{1}{4}\right)^2\left(\frac{3}{4}\right)^2 = 6.\frac{1}{16}.\frac{9}{16} = \frac{27}{128}$.

8.

Soln:

p = Prob. Of getting a six in one throw = 1/6

q = 1 – p = 1 – $\frac{1}{6}$ = $\frac{5}{6}$.

n = No. of throws = 4.

(i) P(3) = $^4C_3.p^3q = 4.\left(\frac{1}{6}\right)^2\left(\frac{5}{6}\right) = 4.\frac{1}{216}.\frac{5}{6} = \frac{5}{324}$.

(ii) P(2) = $^4C_2.p^2q^2 = \frac{4.3}{2}.\left(\frac{1}{6}\right)^2.\left(\frac{5}{6}\right)^2 = 6.\frac{1}{36}.\frac{25}{36} = \frac{25}{216}$.

(iii) P(0) = $^4C_0.p^0q^4 = 1.1.\left(\frac{5}{6}\right)^4 = \frac{625}{1296}$.

9.

Soln:

p = Prob. Of defective bulb = 20% = 1/5

q = 1 – p = 1 – $\frac{1}{5}$ = $\frac{4}{5}$.

n = No. of electric bulb = 4.

(i) P(1) = $^4C_1pq^3 = 4.\left(\frac{1}{5}\right).\left(\frac{4}{5}\right)^3 = \frac{256}{625}$.

(ii) P(0) = $^4C_0.pq^3 = 1.1.\left(\frac{4}{5}\right)^4 = \frac{256}{625}$.

(iii) P(4 ≤ 2) = P(0) + P(1) + P(2) = $^4C_0q^4 + {}^4C_1pq^3 + {}^4C_2p^2q^2 = \frac{256}{625} + \frac{256}{625} + \frac{4.3}{2}\left(\frac{1}{5}\right)^2\left(\frac{4}{5}\right)^2 = \frac{608}{625}$.

10.

Soln:

p = Prob. That a workman is suffering from a occupational disease = 20% = 1/5.

q = 1 – p = 1 – $\frac{1}{5}$ = $\frac{4}{5}$

n = No. of workmen = 6.

P(4 ≥ 4) = P(4) + P(5) + P(6)

= $\frac{6.5}{2}.\left(\frac{1}{5}\right)^2\left(\frac{4}{5}\right)^2 + 6.\left(\frac{1}{5}\right)^2\left(\frac{4}{5}\right) + 1.\left(\frac{1}{5}\right)^6$

= $\frac{240}{15625} + \frac{24}{15625} + \frac{1}{15625} = \frac{52}{3125}$.

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11.

Soln:

p = prob. Of defective electrical fuse = 15% = 0.15

q = 1 – p = 1 – 0.15 = 0.85

n = No. of electrical fuses = 10.

P(r) = Prob. Of r defective in n fuses.

(i) $P(r = 0) = {}^{10}C_0.p^0.q^{10}$.

$= 1.1.(0.85)^{10} = 0.1969$.

(ii) $P(r \geq 1) = 1 – P(0)$

$= 1 – 0.1969 = 0.8031$.

(iii) $P(r \leq 1) = P(0) + P(1)$

$= P(0) + P(1)$

$= P(0) + {}^{10}C_1p^1q^9 = P(0) + 10 * 0.15 * (0.85)^9$.

$= 0.1969 + 0.3474 = 0.5443$.

12.

Soln:

The probability of hitting the target $p = \frac{1}{4}$ and $q = 1 – \frac{1}{4} = \frac{3}{4}$.

n = No .of hitting = 5.

P(r) = Probability of r successes in trials = ${}^nC_rp^rq^{n-r}$.

(i) $P(0) = {}^5C_0\left(\frac{1}{4}\right)^0\left(\frac{3}{4}\right)^5 = 1.1.\frac{243}{1024} = \frac{243}{1024}$.

(ii) $P(1) = {}^5C_1\left(\frac{1}{4}\right)^1.\left(\frac{3}{4}\right) = 5.\frac{1}{4}.\frac{81}{256} = \frac{40}{1024}$.

(iii) $P(r \geq 2) = 1 – P(0) – P(1)$.

$= 1 – \frac{243}{1024} – \frac{405}{1024} = \frac{376}{1024} = \frac{47}{128}$.

13.

Soln:

p = Prob. Of a male birth = 52% = 0.52

q = 1 – p = 1 – 0.52 = 0.48.

n = No, of births = 5.

P(r) = Prob. of r male births.

$= {}^nC_r.p^r.q^{n-r}$.

(i) $P(3) = {}^5C_3p^3q^2 = \frac{5.4}{2}.(0.52)^3.(0.48)^2 = 0.324$.

(ii) $P(r \geq 2) = P(0) + P(1) + P(2)$

$= {}^5C_0.p^o.q^5 + {}^5C_1p^1.q^4 + {}^5C_2p^2q^3$.

$= 1.1.(0.48)^5 + 5.(0.52).(0.48)^4 + \frac{5.4}{2}(0.52)^2(0.48)^2$

$= 0.0255 + 0.1380 + 0.2990 = 0.4625$.

(iii) P(r > 4) = P(5) = ${}^5C_5.p^5.q^o = 1 * (0.52)^5 * 1 = 0.038$.

14.

a.

Soln:

p= Prob. of getting an even no. = $\frac{1}{2}$.

q = 1 – $\frac{1}{2}$ = $\frac{1}{2}$, n = 16.

Mean = np = 16 * $\frac{1}{2}$ = 8,

s.d = $\sqrt{npq}$ = $\sqrt{16*\frac{1}{2}*\frac{1}{2}}$ = 2.

b.

Soln:

P(r) = $C(n,r)p^r.q^{n-r}$.

P(r = 2) = $C(4,2)p^2.q^{4-2}$ = $C(4,2)p^2q^2$.

P(r = 3) = $(4,3).p^3q^{4-3} = C(4,3)p^3q$.

P(r = 2) = P(r = 3).

à$C(4,2)p^2q^2 = C(4,3)p^3q$.

à$\frac{4*3}{2}p^2q^2 = 4p^3q$

à3q = 2p

à 3(1 – p) = 2p

à3 – 3p = 2p

à 5p = 3

So, p = $\frac{3}{5}$.

q = 1 – p = 1 – $\frac{3}{5}$ = $\frac{2}{5}$.

$P(r = 1) = C(4,1)p^1q^{4-1}. = 4pq^3$

= 4 * $\frac{3}{5}$ * $\left(\frac{2}{5}\right)^3$ = $\frac{96}{625}$.

15.

Soln:

p = probability of a boy = $\frac{24}{132}$ = $\frac{3}{2}$, q = 1 – $\frac{3}{4}$ = $\frac{1}{4}$.

$P(r) = C(n,r)p^rq^{n-r}$.

a. P(r = 1) = $C(3,1)\left(\frac{3}{4}\right)^1.\left(\frac{1}{4}\right)^{3-1}$ = 3 * $\frac{3}{4}$ * $\frac{1}{16}$ = $\frac{9}{64}$.

b. P(r = 2) = $C(3,2)\ \left(\frac{3}{4}\right)^2\left(\frac{1}{4}\right)^{3-2}$ = 3 * $\frac{9}{16}$ * $\frac{1}{4}$ = $\frac{27}{64}$.

c. P(r = 0) = $C(3,0)p^oq^{3-0}$ = 1.1.$\left(\frac{1}{4}\right)^3$ = $\frac{1}{64}$.