2a) $P(1,2,3,6) = \dfrac{1}{{}^{10}C_4}$

total possibilities

17 a) $P(3 \text{ each group}) = \dfrac{\frac{{}^6C_3}{2}}{31}$ $= \dfrac{{}^6C_3}{2} + {}^6C_2 + {}^6C_1$

$= 31$

3c) 3R, 7Y, 5B

$$P(2R, 1B) = \frac{{}^{3}C_2 \times {}^{5}C_1}{{}^{15}C_3}$$

d) $$P(\text{different colours}) = \frac{{}^{3}C_1 \times {}^{7}C_1 \times {}^{5}C_1}{{}^{15}C_3}$$

$$= \frac{3}{13}$$

5b) $P(3\text{ Ace}) = \dfrac{{}^{4}C_3}{{}^{52}C_3}$

c) $P(3\text{ Diamonds}) = \dfrac{{}^{13}C_3}{{}^{52}C_3}$

d) $P(\text{same suit}) = 4 \times \dfrac{{}^{13}C_3}{{}^{52}C_3}$

e) $P(\text{picture cards}) = \dfrac{{}^{12}C_3}{{}^{52}C_3}$

f) $P(2R, 1B) = \dfrac{{}^{26}C_2 \times {}^{26}C_1}{{}^{52}C_3}$

g) $P(7, 8, 9) = \dfrac{{}^{4}C_1 \times {}^{4}C_1 \times {}^{4}C_1}{{}^{52}C_3}$

h) $P(2 \times 7\text{'s}, 6) = \dfrac{{}^{4}C_2 \times {}^{4}C_1}{{}^{52}C_3}$

i) $P(1\ \diamond) = \dfrac{{}^{13}C_1 \times {}^{39}C_2}{{}^{52}C_3}$

j) $P(\geq 2\ \diamond) = \dfrac{{}^{13}C_2 \times {}^{39}C_1 + {}^{13}C_3}{{}^{52}C_3}$

7b) $P(B, G \text{ together}) = \dfrac{2 \times 3! \times 3!}{6!}$

7c) $P(G_1 G_2 \text{ next}) = \dfrac{2!\,5!}{6!}$

9

a) $P(\text{P, J at ends}) = \dfrac{2!\,4!}{6!}$

b) $P(\text{P, J not next}) = 1 - P(\text{P, J next})$

$= 1 - \dfrac{2!\,5!}{6!}$

11)

3 3 4 4 4 5

a) $P(\text{even}) = \frac{3}{6}$ ← probability last number is even.

$= \frac{1}{2}$

$\frac{1 \times 5!}{2!\,2!}$

OR

$$\frac{\dfrac{3 \times 5!}{2!\,3!}}{\dfrac{6!}{2!\,3!}}$$

11 b) $P(\text{ends in } 5) = \dfrac{1 \times \dfrac{5!}{2!\,3!}}{\dfrac{6!}{2!\,3!}}$

c) $P(\text{'444' together}) = \dfrac{\dfrac{4!}{2!}}{\dfrac{6!}{2!\,3!}}$

d) $P(\text{start 5, 4's and 3 alternate}) = \dfrac{1 \times 1}{\dfrac{6!}{2!\,3!}}$

11e) P(3's separated by ≥ 1 number)

5 444 33

$$= \frac{10 \times \frac{4!}{3!}}{\frac{6!}{2!\,3!}}$$

_ _ _ _ _ _

3   3 3 3 3

3   3 3 3

3   3 3 10

3   3

OR

3, 3, 4, 4, 4, 5

3's separated by at least one number

_ 4 _ 5 _ 4 _ 4 _

x   x

$$\frac{\frac{4!}{3!} \times {}^5C_2 = 40}{60}$$

d) P(starts 5, 4, 3 alternate) $= \dfrac{1 \times 1}{\dfrac{6!}{2!\,3!}}$

$= \dfrac{2!\,3!}{6!}$

e) P(3's seperated by at least 1#)

$= 1 -$ P(3's together)

$= 1 - \dfrac{\dfrac{5!}{3!}}{\dfrac{6!}{2!\,3!}}$

13/

KETTLE

no restrictions $= \frac{6!}{2!2!}$

$= 180$

a) P(E's together) $= \frac{\frac{5!}{2!}}{180}$

$= \frac{60}{180} = \frac{1}{3}$

b) P(2 E's not together) $= \frac{2}{3}$

c) P(EE and TT) $= \frac{4!}{180}$

$= \frac{24}{180} = \frac{2}{15}$

d) P(E's, T's together)

$= \frac{\frac{4!}{2!2!} \times 3!}{180}$

$= \frac{36}{180} = \frac{1}{5}$

d) P('Es and Ts' together)

$= \frac{\frac{4!}{2!2!} \times 3!}{\frac{6!}{2!2!}}$

15/ 20 T, 80 U

$$P(UUUU) = \frac{{}^{80}C_4}{{}^{100}C_4} = 0.403$$

b) $P(\geq 1T) = 1 - P(UUUU)$
$= 0.597$

c) P('UUUU' every day for a week) $= (0.403)^7$

d) P('UUUU' on 3 of 7 days) $= \frac{7!}{4!\,3!}(0.403)^3(0.597)^4$

arrange

$^7C_3$

NNN TTTT

17) 6p, 2 groups $\geq$ 1p

no restrictions $= {}^6C_1 + {}^6C_2 + \dfrac{{}^6C_3}{2}$

$= \underline{\underline{31}}$

$$\boxed{\left|\; {}^6C_0 \;\middle|\; {}^6C_1 \;\; {}^6C_2 \;\; {}^6C_3 \;\; {}^6C_4 \;\; {}^6C_5 \;\middle|\; {}^6C_4 \;\right|} = 2^6 - 2$$

a) P(3 each group) $= \dfrac{\frac{{}^6C_3}{2}}{31} = \underline{\dfrac{10}{31}}$

b) P(2 , 4) $= \dfrac{{}^6C_2}{31} = \underline{\dfrac{15}{31}}$

c) P(1, 5) $= \dfrac{{}^6C_1}{31} = \underline{\dfrac{6}{31}}$

19 total poss = $\overset{①}{4} + \overset{②}{{}^4P_2} + \overset{③}{{}^4P_3} + \overset{④}{{}^4P_4}$

$= 64$

a) $P(3 \text{ digits}) = \dfrac{{}^4P_3}{64}$

b) $P(\text{even}) = \dfrac{1}{2}$

b) $P(\text{even}) = \dfrac{2 \times (1 + {}^3P_1 + {}^3P_2 + {}^3P_3)}{64}$

c) $P(> 200) = \dfrac{3 \times {}^3P_2 + 4!}{64}$

d) $P(\text{odd}, > 3000) = \dfrac{1 \times 1 \times 2! + 1 \times 2 \times 2!}{64}$

e) $P(\div 3) = \dfrac{1 + 2 \times 2! + 2 \times 3!}{64}$

1 2
2 4

2 3 4
1 2 3

21/

A $1 \to 10$ B $1 \to 10$ C $1 \to 10$ D $1 \to 10$

Total ways $= {}^{40}C_5$

a) $P(\text{three '4', two '9'}) = \dfrac{{}^4C_3 \times {}^4C_2}{{}^{40}C_5}$

b) $P(\geq 4 \text{ from same tea}) = P(4 \text{ same}) + P(5 \text{ same})$

$$= \frac{{}^4C_1 \times {}^{10}C_4 \times {}^{30}C_1 + {}^4C_1 \times {}^{10}C_5}{{}^{40}C_5}$$

22

a) $P(\text{pair}) = \dfrac{{}^{13}C_1 \times {}^{4}C_2 \times {}^{12}C_3 \times {}^{4}C_1 \times {}^{4}C_1 \times {}^{4}C_1}{{}^{52}C_5}$

b) $P(2\text{ pairs}) = \dfrac{{}^{13}C_2 \times {}^{4}C_2 \times {}^{4}C_2 \times {}^{44}C_1}{{}^{52}C_5}$

c) $P(3\text{ of knd}) = \dfrac{{}^{13}C_1 \times {}^{4}C_3 \times {}^{12}C_2 \times {}^{4}C_1 \times {}^{4}C_1}{{}^{52}C_5}$

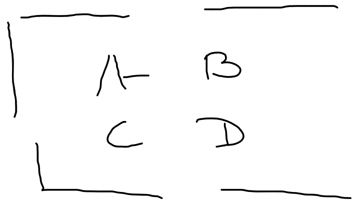
d) $P(4\text{ of a knd})$

$= \dfrac{{}^{13}C_1 \times {}^{4}C_4 \times {}^{48}C_1}{{}^{52}C_5}$

f) $P(\text{straight}) = \dfrac{9 \times 4 \times 4 \times 4 \times 4 \times 4}{{}^{52}C_5}$

$:\ {}^{9}C_{1} = 9$

23d)



d) $P(\leq 2 \text{ go out same})$

$= 1 - P(\text{all 4 out same})$

$- P(\text{3 use same, 1 another})$

$= 1 - \frac{1}{125} - \frac{16}{125}$

$= \underline{\underline{\frac{108}{125}}}$

a) $P(\text{all 4 out same}) = \frac{1}{125}$

b) $P(\text{ABC use same, D another}) = \frac{4}{125}$

c) $P(\text{3 use same, 1 another}) = \frac{16}{125}$

d) $P(\text{no more 2 use same})$

$= 1 - P(\text{all 4 same}) - P(\text{3 use same})$

$= 1 - \frac{5}{5^4} - \frac{4(3 \times 5 \times 4}{5^4}$

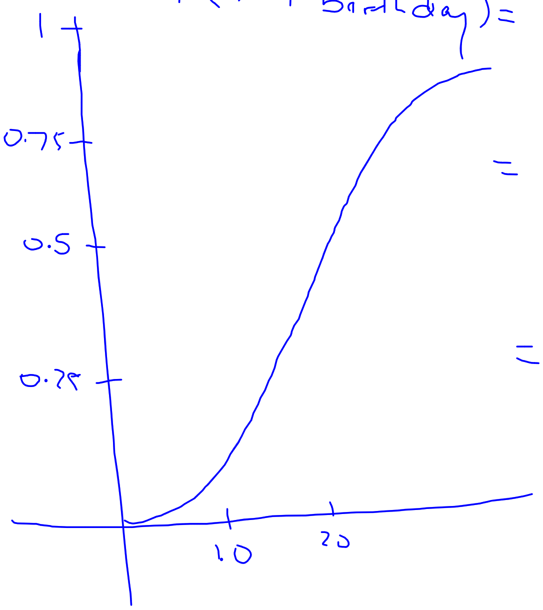
25

a)

$$P(\geq 1 \text{ birthday}) = 1 - P(0 \text{ birthday})$$

$$= 1 - \frac{{}^{365}P_3}{365^3}$$

$$= 1 - \frac{{}^{365}P_n}{365^n}$$



25 $P(\geq 1 \text{ in common}) = 1 - P(\text{no common birthday})$

$$= 1 - \frac{{}^{365}P_3}{365^3}$$

$$= \underline{0.0082}$$

b) n people $= 1 - \dfrac{{}^{365}P_n}{365^n}$

c) $1 - \frac{{}^{365}P_n}{365^n} > 0.5$

$$\frac{{}^{365}P_n}{365^n} < 0.5$$

d) 23

e) 41

27

$P(\text{any 2 players meet})(8 \text{ players})$

$$= \frac{1}{7} + \frac{6}{7} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{3} + \frac{6}{7} \times \frac{2}{3} \times \frac{1}{4} \times \frac{1}{4}$$

$$= \underline{\underline{\frac{1}{4}}}$$

b) $P(2 \text{ players meet} / 16 \text{ players})$

$$= \frac{1}{15} + \frac{14}{15} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{4}$$

$$= \frac{1}{8}$$

c) $P(2 \text{ players meet} / 2^n \text{ players})$

$$= \frac{1}{2^{n-1}}$$