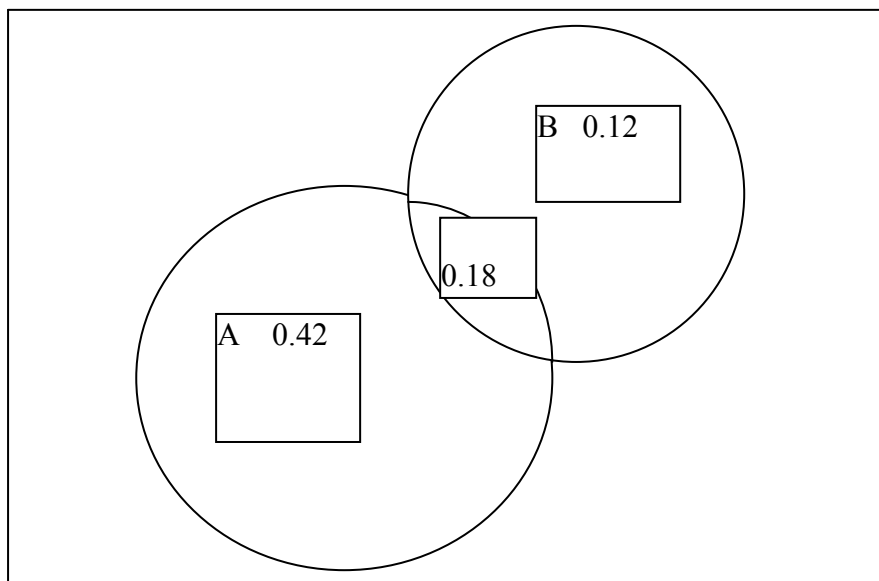


Mathematics S1

1. (a) $P(A \cap B) = 0.6 \times 0.3$ B1
 $P(A \cup B) = 0.6 + 0.3 - 0.6 \times 0.3$ M1
 $= 0.72$ A1
- (b) EITHER
 $P(B') = 1 - P(B) = 0.7$ B1
 $P(A \cup B') = P(A) + P(B') - P(A)P(B')$ M1
 $= 0.6 + 0.7 - 0.6 \times 0.7 = 0.88$ A1

OR



Correct Venn diagram

Required prob = $1 - 0.12 = 0.88$

2. (a) $E(Y) = 3 \times 4 - 1 = 11$ M1A1
 $\text{Var}(Y) = 9 \times 2 = 18$ M1A1
- (b) $E(Y^2) = \text{Var}(Y) + \{E(Y)\}^2$ M1
 $= 18 + 121 = 139$ A1
[FT 1 arithmetic slip in (a)]
3. (a) Mean = 6 si B1
- (i) $\text{Prob} = e^{-6} \times \frac{6^3}{3!} = 0.0892$ M1A1
- (ii) $\text{Prob} = 1 - 0.7149 = 0.2851$ M1A1
[FT on mean]
- (b) Prob of no arrivals = $e^{-0.1t}$ B1
Attempting to solve $e^{-0.1t} = 0.25$ M1
 $-0.1t \log e = \log 0.25$ A1
 $t = -\frac{\log 0.25}{0.1 \log e} = 13.86$ A1
[Award 2 marks for 14 using tables]

4. (a) Prob wins on 1st throw = $0.8 \times 0.3 = 0.24$ M1A1
- (b) Prob wins on 2nd throw = $0.8 \times 0.7 \times 0.8 \times 0.3 = 0.1344$ M1A1
[FT from (a) if M1 awarded in (a)]
- (c) Prob wins = $0.24 + 0.24 \times 0.56 + 0.24 \times 0.56^2 + \dots$ M1A1

$$= \frac{0.24}{1 - 0.56} = 6/11 \text{ (0.55)}$$
 M1A1
- [For candidates who solve for Bill first, award M0A0 for (a), M1A1 for 0.168 in (b), M1A1 for $0.3 + 0.3 \times 0.56 + \dots$ and M1A1 for $0.3/(1 - 0.56) = 15/22$ (0.68) in (c)]
5. (a) $P(\text{correct ans}) = 0.6 \times 1 + 0.4 \times 0.25$ M1A1

$$= 0.7$$
 A1
 [Award M1 if 1 and 0.25 reversed]
- (b) Reqd prob = $\frac{0.6}{0.7}$ [FT denominator from (a) if answer < 1] B1B1

$$= \frac{6}{7} \text{ cao}$$
 B1
6. (a) $\sum p_x = 16k = 1$ so $k = 1/16$ M1A1
- (b) (i) $E(X) = \frac{1}{16}(1 \times 1 + 3 \times 3 + 5 \times 5 + 7 \times 7)$ M1

$$= 5.25 \text{ [Accept } 84k]$$
 A1
- (ii) $E\left(\frac{1}{X}\right) = \frac{1}{16}\left(1 \times \frac{1}{1} + 3 \times \frac{1}{3} + 5 \times \frac{1}{5} + 7 \times \frac{1}{7}\right)$ M1A1

$$= 0.25 \text{ [Accept } 4k]$$
 A1
- (c) (i) Possibilities are 1,5 and 3,3 si B1
 Prob = $\frac{1}{256}(1 \times 5 + 5 \times 1 + 3 \times 3)$ M1A1
 [Award M1 for 2 or 3 terms]

$$= \frac{19}{256} \text{ (0.074)} \quad [\text{Accept } 19/k^2]$$
 A1
- (ii) Possibilities are 1,1 ; 3,3 ; 5,5 ; 7,7 si B1
 Prob = $\frac{1}{256}(1^2 + 3^2 + 5^2 + 7^2)$ M1
 [Award M1 for 3 or 4 terms]

$$= 0.328 \text{ (21/64)} \quad [\text{Accept } 84/k^2]$$
 A1

7. (a) Number of 6s obtained, X , is $B(50, 0.2)$ B1
- (i) $\text{Prob} = \binom{50}{12} \times 0.2^{12} \times 0.8^{38} = 0.1033$
or $0.8139 - 0.7107$ or $0.2893 - 0.1861 = 0.1032$ M1A1
- (ii) $P(\text{at least } 10) = 0.5563$ or $1 - 0.4437 = 0.5563$ M1A1
- (b) Prob of 2 6s $= 0.2^2 = 0.04$ B1
 X is now $B(200, 0.04)$ which is approx $P(8)$ B1
[FT p from previous line]
 $P(5 \leq X \leq 10) = 0.8159 - 0.0996$ or $0.9004 - 0.1841$ B1B1
 $= 0.7163$ cao B1
8. (a) $\int_0^1 kx(1-x^2)dx = 1$ M1
- Integral $= k \left[\frac{x^2}{2} - \frac{x^4}{4} \right]_0^1$ B1
- [Limits must appear somewhere for M1]
 $= \frac{k}{4}$ A1
- so $k = 4$
- (b) $E(X) = \int_0^1 x \cdot 4x(1-x^2)dx$ M1A1
- $= \left[\frac{4x^3}{3} - \frac{4x^5}{5} \right]_0^1$ A1
- [Limits not required until 2nd line]
 $= \frac{8}{15}$ A1

- (c) (i) $F(x) = \int_0^x 4t(1-t^2)dt$ M1
 [Limits not required for M1]
 $= [2t^2 - t^4]_0^x$ A1
 [Limits must appear here]
 $= 2x^2 - x^4$ A1
- (ii) Prob = $F(0.75) - F(0.25)$
 $= 2 \times 0.75^2 - 0.75^4 - (2 \times 0.25^2 - 0.25^4)$ M1
 $= 0.6875$ A1
 [FT if M1 awarded in (c)(i) and answer sensible]
- (iii) The median m satisfies
 $2m^2 - m^4 = 0.5$ M1
 [FT from (c)(i) if M1 awarded there]
 $2m^4 - 4m^2 + 1 = 0$ A1
 $m^2 = \frac{4 \pm \sqrt{8}}{4}$ m1
 $m = 0.541$ cao A1