# 4.1 concept\_reliablity\_and\_Sampling techniques\_P\_2

**1a.** *[1 mark]*

## Markscheme

6.75      ***A1***

***[1 mark]***

**1b.** *[1 mark]*

## Markscheme

2.22      ***A1***

***[1 mark]***

**1c.** *[1 mark]*

## Markscheme

8.75      ***A1***

***[1 mark]***

**1d.** *[1 mark]*

## Markscheme

2.22      ***A1***

***[1 mark]***

**1e.** *[3 marks]*

## Markscheme

the order is 3, 4, 6, 7, 7, 8, 9, 10

median is currently 7        ***A1***

**Note:** This can be indicated by a diagram/list, rather than actually stated.

with 9 numbers the middle value (median) will be the 5th value      ***R1***

which will correspond to 7 regardless of whether the position of the median moves up or down      ***R1***

**Note:** Accept answers using data 5, 6, 8, 9, 9, 10, 11, 12 (ie from part (b)).

***[3 marks]***

**2a.** *[2 marks]*

## Markscheme



    ***(M1)***

= 0.102     ***A1***

***[2 marks]***

**2b.** *[2 marks]*

## Markscheme

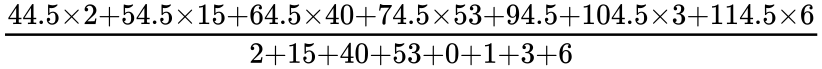
standard deviation =  (= 8.37)   ***(M1)A1***

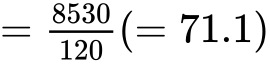
***[2 marks]***

**2c.** *[3 marks]*

## Markscheme

use of midpoints (accept consistent use of 45, 55 etc.)  ***(M1)***

   ***(M1)***

      ***A1***

**Note:** If 45, 55, etc. are used consistently instead of midpoints (implied by the answer 71.58…) award ***M1M1A0***.

***[3 marks]***

**2d.** *[2 marks]*

## Markscheme

13.9  ***(M1)A1***

***[2 marks]***

**2e.** *[1 mark]*

## Markscheme

valid reason given to include the examples below       ***R1***

variance is 192 which is not close to the mean (accept not equal to) standard deviation too high (using parts (a)(ii) and (b)(ii))

relative frequency of  ≤ 59 is 0.142 which is too high (using part (a)(i))

Poisson would give a frequency of roughly 14 for 80 ≤  ≤ 89

**Note:** Reasons which do not use values found in previous parts must be backed up with numerical evidence.

***[1 mark]***

**2f.** *[3 marks]*

## Markscheme



      ***(M1)***

attempt to solve a correct equation       ***(M1)***

*λ*= 20.1       ***A1***

***[3 marks]***

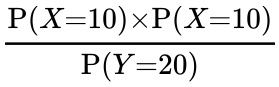
**2g.** *[5 marks]*

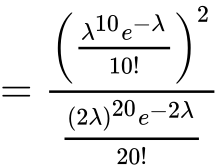
## Markscheme

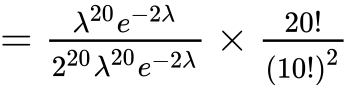
in 1 day, no of emails is *X* ~ Po(*λ*)

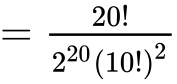
in 2 days, no of emails is *Y* ~ Po(2*λ*)       ***(A1)***

P(10 on first day | 20 in 2 days)        ***(M1)***

        ***(M1)***

     ***A1***

      ***A1***



which is independent of *λ*       ***AG***

***[5 marks]***

**3a.** *[3 marks]*

## Markscheme

\* This question is from an exam for a previous syllabus, and may contain minor differences in marking or structure.

    ***A1***

    ***AG***

    ***(M1)***

 (or equivalent)     ***A1***

    ***AG***

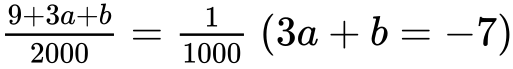
***[3 marks]***

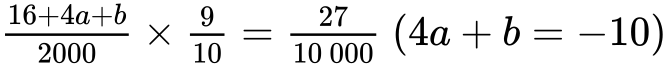
**3b.** *[5 marks]*

## Markscheme

**METHOD 1**

attempting to form equations in  and      ***M1***

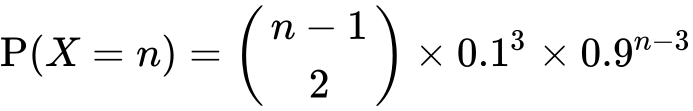
    ***A1***

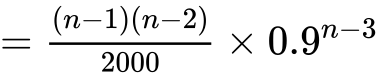
    ***A1***

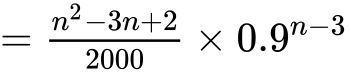
attempting to solve simultaneously     ***(M1)***

    ***A1***

**METHOD 2**

    ***M1***

    ***(M1)A1***

    ***A1***

    ***A1***

**Note:** Condone the absence of  in the determination of the values of  and .

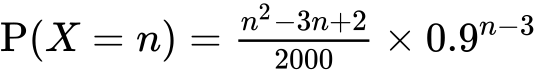
***[5 marks]***

**3c.** *[4 marks]*

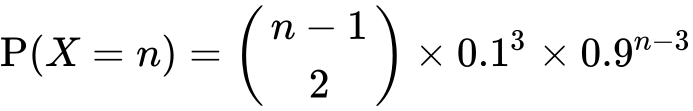
## Markscheme

**METHOD 1**

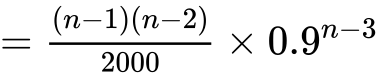
**EITHER**

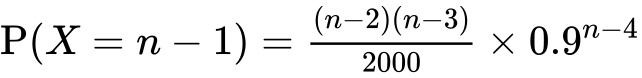
    ***(M1)***

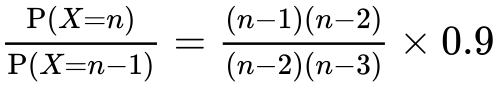
**OR**

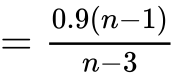
    ***(M1)***

**THEN**

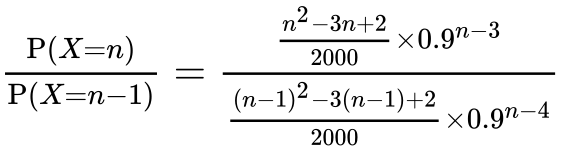
    ***A1***

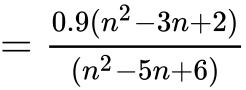
    ***A1***

    ***A1***

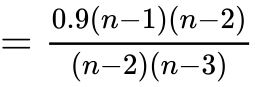
    ***AG***

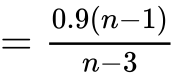
**METHOD 2**

    ***(M1)***

    ***A1A1***

**Note:** Award ***A1*** for a correct numerator and ***A1*** for a correct denominator.

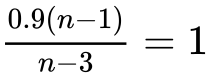
    ***A1***

    ***AG***

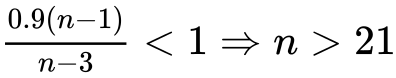
***[4 marks]***

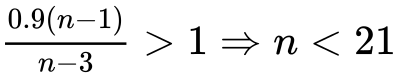
**3d.** *[5 marks]*

## Markscheme

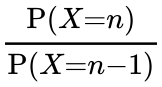
(i)     attempting to solve  for      ***M1***

    ***A1***

    ***R1***

    ***R1***

 has two modes     ***AG***

**Note:** Award ***R1R1*** for a clearly labelled graphical representation of the two inequalities (using ).

(ii)     the modes are 20 and 21     ***A1***

***[5 marks]***

**3e.** *[3 marks]*

## Markscheme

**METHOD 1**

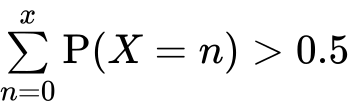
    ***(A1)***

attempting to solve  (or equivalent *eg* ) for      ***(M1)***

**Note:** Award ***(M1)*** for attempting to solve an equality (obtaining ).

    ***A1***

**METHOD 2**

    ***(A1)***

attempting to solve for      ***(M1)***

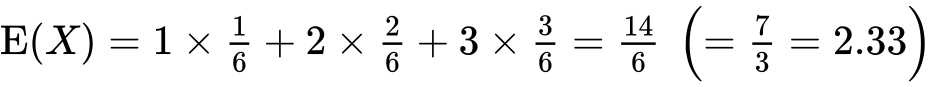
    ***A1***

***[3 marks]***

**4a.** *[2 marks]*

## Markscheme

\* This question is from an exam for a previous syllabus, and may contain minor differences in marking or structure.

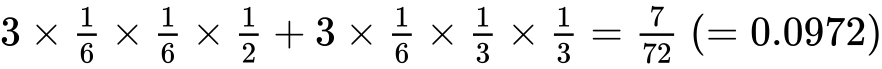
     ***(M1)A1***

***[2 marks]***

**4b.** *[3 marks]*

## Markscheme

     ***(M1)***

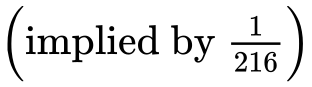
     ***A1***

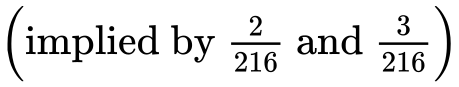
**Note:** Award ***M1*** for attempt to find at least four of the cases.

***[3 marks]***

**4c.** *[3 marks]*

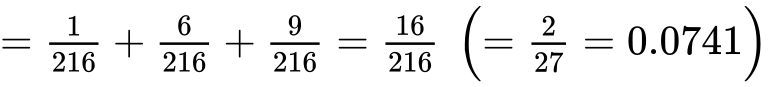
## Markscheme

recognising 111 as a possibility      ***(M1)***

recognising 112 and 113 as possibilities      ***(M1)***

seeing the three arrangements of 112 and 113     ***(M1)***

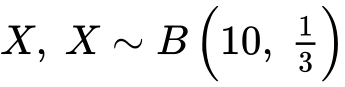


     ***A1***

***[3 marks]***

**4d.** *[3 marks]*

## Markscheme

let the number of twos be      ***(M1)***

     ***(M1)A1***

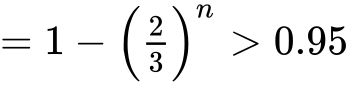
***[3 marks]***

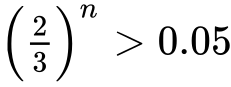
**4e.** *[3 marks]*

## Markscheme

let  be the number of balls drawn

     ***M1***

     ***M1***

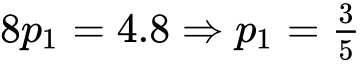


     ***A1***

***[3 marks]***

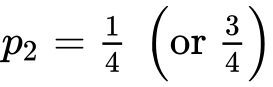
**4f.** *[8 marks]*

## Markscheme

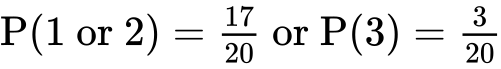
     ***(M1)A1***

     ***(M1)***

     ***(M1)***

     ***A1***

reject  as it gives a total greater than one

     ***(A1)***

recognising LCM as 20 so min total number is 20     ***(M1)***

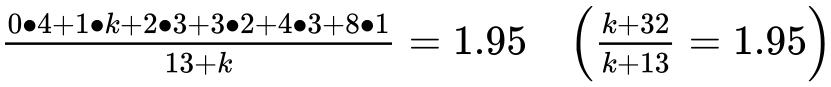
the least possible number of 3’s is 3     ***A1***

***[8 marks]***

**5a.** *[3 marks]*

## Markscheme

\* This question is from an exam for a previous syllabus, and may contain minor differences in marking or structure.

     ***(M1)***

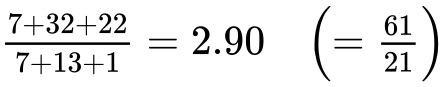
attempting to solve for      ***(M1)***

     ***A1***

***[3 marks]***

**5b.** *[3 marks]*

## Markscheme

(i)          ***(M1)A1***

(ii)     standard deviation      ***A1***

**Note:** Award ***A0*** for .

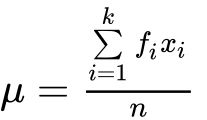
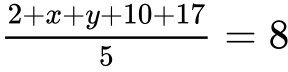
***[3 marks]***

***Total [6 marks]***

**6.** *[6 marks]*

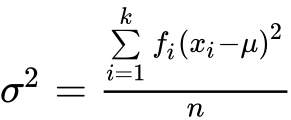
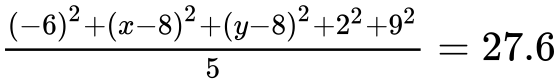
## Markscheme

\* This question is from an exam for a previous syllabus, and may contain minor differences in marking or structure.

use of  to obtain      ***(M1)***

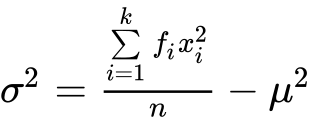
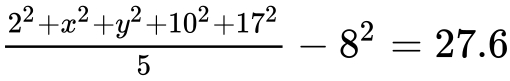
     ***A1***

**EITHER**

use of  to obtain      ***(M1)***

     ***A1***

**OR**

use of  to obtain      ***(M1)***

     ***A1***

**THEN**

attempting to solve the two equations     ***(M1)***

and***A1     N4***

**Note:** Award ***A0*** for  and .

**Note:** Award ***(M1)A1(M0)A0(M1)A1*** for  and .

***[6 marks]***

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