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|  **Question** | **Scheme** | **Marks** | **AOs** |
| **1(a)** | Degrees of freedom (2 – 1)(2 – 1) → = 3.841 | M1 | 3.1b |
|  | [0.245 < 3.841, therefore do not reject ]There is not enough evidence to suggest an association between age and time spent on social media. | A1 | 2.2b |
|  |  | **(2)** |  |
| **(b)** | Some of the expected frequencies may fall below 5 | B1 | 3.5b |
|  |  | **(1)** |  |
| **(c)** |  | M1 | 2.1 |
|  |  awrt **9.57** | A1 | 1.1b |
|  |   | B1 | 3.1b |
|  | [9.57 > 9.488, therefore reject ]There is an association between age and time spent on social media. | A1 | 2.2b |
|  |  | **(4)** |  |
| **(d)** | Part (c) uses more information, so should be more reliable. | B1 | 3.2b |
|  |  | **(1)** |  |
| **(8 marks)** |
| **Notes** |
| **(a)** | M1 Finding the critical value for the testA1 Correct conclusion in context |
| **(b)** | B1 Understanding that to carry out the test, expected frequencies should be > 5 |
| **(c)** | M1 Calculating the test statisticA1 awrt 9.57B1 Obtaining correct degrees of freedom and critical value for the testA1 Correct contextual conclusion |
| **(d)** | B1 Correct choice of conclusion and supporting reason |

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| **Question** | **Scheme** | **Marks** | **AOs** |
| **2(a)** |  | M1 | 3.1a |
|  | M1 | 1.1b |
|  and  | A1 | 1.1b |
|  | **(3)** |  |
| **(b)** | P(9 – *Y* > 0) [= P(9 –  > 0] = P(*X* < 3)  | M1 | 1.1b |
|  | = P(*X* = 2)  | A1 | 1.1b |
|  |  | **(2)** |  |
| **(c)(i)** |  **7.2** | B1 | 1.1b |
|  | **(1)** |  |
| **(ii)** |  awrt **6.77** | B1 | 1.1b |
|  | **(1)** |  |
| **(d)** |  | M1 | 3.3 |
| [= 1 – 0.88667…] | M1 | 1.1b |
|  awrt **0.113**  | A1 | 1.1b |
|  | **(3)** |  |
| **(10 marks)** |
| **Notes** |
| **(a)** | 1st M1 Realising that both equations are required2nd M1 Solving simultaneously to eliminate one variableA1 Both *a* = 0.58 and *b* = 0.36  |
| **(b)** | M1 For identifying P([–3 < ]*X* < 3) or P(*Y* < 9) |
| **(d)** | 1st M1 Selecting Poisson approximation to binomial2nd M1 Using Poisson modelA1 awrt 0.113NB: Using exact binomial  |

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| **Question** | **Scheme** | **Marks** | **AOs** |
| **3(a)** | *r* = 80 × P(*X =* 2) *s* = 80 – (6.56 + 17.11 + …) or *s* = 80 × (1 – P(*X* < 4)) | M1 | 3.4 |
|  *r* = awrt **21.57** and *s =* awrt **6.99** | A1 | 1.1b |
|  | **(2)** |  |
| **(b)** | H0: B(30, 0.08) is a suitable modelH1: B(30, 0.08) is not a suitable model | B1 | 2.5 |
|  | M1 | 2.1 |
|  = awrt **11.5** | A1 | 1.1b |
| Degrees of freedom = 6 – 1 = 5 | B1 | 1.1b |
| 11.5 > so reject H0 | M1 | 1.1b |
| B(30, 0.08) is not a suitable model for the number of empty hotel rooms. | A1 | 3.5a |
|  | **(6)** |  |
| **(c)** | Using the data to estimate *p* = 2  | M1 | 3.3 |
|  |   | A1 | 1.1b |
|  |  | **(2)** |  |
| **(10 marks)** |
| **Notes** |
| **(a)** | M1 Either correct calculationA1 both *r* = awrt **21.57** and *s =* awrt **6.99** |
| **(b)** | B1 Both hypotheses 1st M1 Attempting to find the test statistic using 1st A1 awrt 11.5B1 for df = 52nd M1 comparing test statistic with critical value2nd A1 correct conclusion in context |
| **(c)** | M1 Suggesting using the data to improve the modelA1 Correct model (also allow Po(2))  |

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|  **Question** | **Scheme** | **Marks** | **AOs** |
| **4(a)** | [*X* ~ Po(2.4) *Y* ~ Po(1.6)] P(*X* = 2) = = 0.261… P(*Y* = 2) = = 0.258… | M1 | 1.1b |
|  | Therefore the photocopier is more likely to break down exactly twice. | A1 | 1.1b |
|  |  | **(2)** |  |
| **(b)** | P(*X* < 1) × P(*Y* < 1) | M1 | 1.1b |
| [= 0.3084… × 0.5249…] awrt **0.162** | A1 | 1.1b |
|  | **(2)** |  |
| **(c)** |   | M1 | 3.1b |
|  | M1M1 | 1.1b1.1b |
|  awrt **0.475** | A1 | 1.1b |
|  | **(4)** |  |
|  |
| **(d)** | H0:   H1:   | B1 | 2.5 |
| *T* ~ Po(8) P(*T* < 3) [= awrt 0.0424] | M1 | 3.3 |
| [0.0424 < 0.05] Reject H0 | M1 | 1.1b |
| There is evidence that the rate of breakdowns has decreased following the repairs. | A1 | 1.1b |
|  | **(4)** |  |
| **(12 marks)** |
| **Notes** |
| **(a)** | M1 Using each Poisson model to attempt each probability A1 Both correct awrt 3sf and correct conclusion  |
| **(b)** | M1 Multiplication of two correct cumulative probabilitiesA1 awrt 0.162 |
| **(c)** | 1st M1 Correct ratio expression2nd M1 Use of  [0.125… × 0.201… + 0.209… × 0.323…]3rd M1 Ratio of probabilities with denominator  [0.195…]A1 awrt 0.475 |
| **(d)** | B1 Both hypotheses with  or 1st M1 Using Po(8) to calculate P(*T* < 3)2nd M1 Correct non-contextual conclusionA1 Conclusion in context and no errors |