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| **Q** | **Scheme** | **Marks** | **AOs** | **Pearson Progression Step and Progress descriptor** |
| **1a** | There are a very large number of bags. | **B1** | 2.4 | 3rdComment on the advantages and disadvantages of samples and censuses. |
| Bags are tested to destruction – there would be no bags left. | **B1** | 2.4 |
|  | **(2)** |  |  |
| **1b** | One value is less than 12 kg  | **B1** | 2.4 | 3rdComment on the advantages and disadvantages of samples and censuses. |
| therefore claim is not reliable. | **B1** | 2.3 |
|  | **(2)** |  |  |
| **1c** | Different samples can lead to different conclusions due to natural variations. | **B1** | 2.3 | 3rdComment on the advantages and disadvantages of samples and censuses. |
| Only a small sample taken so unreliable. | **B1** | 2.3 |
|  | **(2)** |  |  |
| **1d** | Larger sample. | **B1** | 2.4 | 3rdComment on the advantages and disadvantages of samples and censuses. |
|  | **(1)** |  |  |
| **(7 marks)** |
| **Notes** |

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| **Q** | **Scheme** | **Marks** | **AOs** | **Pearson Progression Step and Progress descriptor** |
| **2** | = −2.335 (seen or implied)= 2.5 + 755.0= 749.1625 (Accept awrt 749)*σy* = = 6.3594…*σx* = 2.5 × 6.3594…= 15.8986… (Accept awrt 15.9) | **B1****M1****M1****A1****M1 A1****A1****M1****A1** | 1.1b3.1a1.1b1.1b1.1b1.1b3.1a1.1b1.1b | 5thCalculate the mean and standard deviation of coded data. |
|  | **(9)** |  |  |
| **(9 marks)**  |
| **Notes** |

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| **Q** | **Scheme** | **Marks** | **AOs** | **Pearson Progression Step and Progress descriptor** |
| **3a** | Total frequency = 120P(Less than 17 cm) or equivalent or 0.475 | **B1****M1****A1** | 3.1a1.1b1.1b | 2ndCalculate probabilities from relative frequency tables and real data. |
|  | **(3)** |  |  |
| **3b** | P(Between 12cm and 18 cm)  or awrt 0.558Assumption: foot lengths between 17 and 19 are uniformly distributed. | **M1****A1****B1** | 2.2b1.1b3.5b | 2ndCalculate probabilities from relative frequency tables and real data. |
|  | **(3)** |  |  |
| **(6 marks)** |
| **Notes** |

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| **Q** | **Scheme** | **Marks** | **AOs** | **Pearson Progression Step and Progress descriptor** |
| **4a** | 0.15 + 0.15 + ** + ** + 0.1 + 0.1 = 2** + 0.5 = 1 | **M1** | 1.1b | 4thCalculate probabilities from discrete distributions. |
| ** = 0.25 | **A1** | 1.1b |
|  | **(2)** |  |  |
| **4b** | P(–1 ⩽*X* < 2) = P(–1) + P(0) + P(1) = 0.6 | **B1** | 1.1b | 4thCalculate probabilities from discrete distributions. |
|  | **(1)** |  |  |
| **4c** | P(*X*  > −2.3) = P(−2) + P(−1) + P(0) + P(1) + P(2) = 0.85 | **B1** | 1.1b | 4thCalculate probabilities from discrete distributions. |
|  | **(1)** |  |  |
| **(4 marks)** |
| **Notes** |

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| **Q** | **Scheme** | **Marks** | **AOs** | **Pearson Progression Step and Progress descriptor** |
| **5a** | Let *X* be the random variable the number of games Amir loses.*X* ~ B(9, 0.2)P(*X* = 3) = 0.17616… = 0.176 to 3 sf from calculator | **B1****B1** | 3.31.1b | 5thCalculate binomial probabilities. |
|  | **(2)** |  |  |
| **5b** |  | **M1** | 3.4 | 6thUse statistical tables and calculators to find cumulative binomial probabilities. |
| = awrt 0.980 from calculator | **A1** | 1.1b |
|  | **(2)** |  |  |
| **(4 marks)**  |
| **Notes****5a**= 0.9144 – 0.7382or  or  or **4b**0.98 is M1A0 |

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| **Q** | **Scheme** | **Marks** | **AOs** | **Pearson Progression Step and Progress descriptor** |
| **6a** | Understands that the pole vaulter will land when *h* = 0 or writes  | **M1** | 3.1b | 3rd Understand how mechanics problems can be modelled mathematically. |
| Correctly factorises to get o.e. | **M1** | 1.1b |
| Solves to get (m) Accept awrt 10.4 (m) | **A1** | 1.1b |
|  | **(3)** |  |  |
| **6b** | States that the greatest height will occur when *x* = 5.20…(m) | **M1**  | 3.1b | 3rd Understand how mechanics problems can be modelled mathematically. |
| Makes an attempt to substitute *x* = 5.20…into the equation for *h*. For example, seen. | **M1**  | 1.1b |
| *h* = 5.42…(m) Accept awrt 5.4 (m) | **A1 ft** | 1.1b |
|  | **(3)** |  |  |
| **6c** | States *h* = 4.9 or states that  | **M1** | 3.1b | 3rd Understand how mechanics problems can be modelled mathematically. |
| Simplifies this to reach  o.e. | **M1** | 1.1b |
| Realises that the quadratic formula is needed to solve the quadratic. For example  seen, or makes attempt to use the formula:  | **M1** | 1.1b |
| Simplifies the  part to get 1513 or shows  | **M1** | 1.1b |
| *x* = 6.82…(m)Accept awrt 6.8 (m) | **A1** | 1.1b |
| *x* = 3.58… (m)Accept awrt 3.6 (m) | **A1** | 1.1b |
| The pole vaulter can leave the ground between 3.6 m and 6.8 m from the bar. | **B1** | 3.2a |
|  | **(7)** |  |  |
| **6di** | Allows the person to be treated as a single mass and allows the effects of rotational forces to be ignored. | **B1** | 3.4 | 3rdUnderstand assumptions common in mathematical modelling. |
|  | **(1)** |  |  |
| **6dii** | The effects of air resistance can be ignored. | **B1** | 3.4 | 3rdUnderstand assumptions common in mathematical modelling. |
|  | **(1)** |  |  |
| **(15 marks)**  |
| **Notes****6b**For the first method mark, accept their answer to part **a** divided by 2. Continue to award marks for a correct answer using their initial incorrect value.**6c**Accept 3.6 ⩽ *x* ⩽ 6.8 |

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| **Q** | **Scheme** | **Marks** | **AOs** | **Pearson Progression Step and Progress descriptor** |
| **7a** | Correctly uses to write | **M1** | 3.1b | 5thSolve problems of connected particles using pulleys. |
| Correctly finds *a* =(m s−2) or 2.8125 (m s−2). Accept awrt 2.8 (m s−2). | **A1** | 1.1b |
|  | **(2)** |  |  |
| **7b** | Demonstrates an understanding that the resultant force acting on sphere *B* is 1.2*g* – *T*. | **M1** | 3.1b | 5thSolve problems of connected particles using pulleys. |
| Uses *F* = *ma* to write  | **M1** | 3.3 |
| Correctly solves to find *T* =(N) or 8.385 (N). Accept 8.4 (N). | **A1 ft** | 1.1b |
|  | **(3)** |  |  |
| **7c** | Demonstrates an understanding that the resultant force acting on box *A* is *T* – *F*. | **M1** | 3.1b | 5thSolve problems of connected particles using pulleys. |
| Uses *F* = *ma* to write  | **M1** | 3.3 |
| Correctly solves to find *F* = (N) or 6.135 (N). Accept 6.1 (N). | **A1ft** | 1.1b |
|  | **(3)** |  |  |
| **7d** | Uses *v* = *u* + *at* to write  | **M1** | 3.1b | 5thSolve problems of connected particles using pulleys. |
| Solves to find *v* = or 2.25 m s−1. | **A1 ft** | 1.1b |
| Uses *F* = *ma* to write –*F* = 0.8*a* or −= 0.8*a* | **M1** | 3.1b |
| Solves to find *a* =m s−2 or 7.66…( m s−2). | **A1 ft** | 1.1b |
| Uses  to write  | **M1** | 2.2a |
| Solves to find *s* =(m) or 0.33… (m). Accept awrt 0.33 (m). | **A1 ft** | 1.1b |
| States that the total distance travelled will be 1.23 m (0.9 + 0.33). | **B1 ft** | 3.2 |
|  | **(7)** |  |  |
| **(15 marks)**  |
| **Notes****7b**Award ft marks for a correct answer using their value from part **a** for acceleration.**7c**Award ft marks for a correct answer using their values from part **a** for acceleration and part **b** for tension.**7d**Award ft marks for a correct answer using their values from parts **a**, **b** and **c**. |