**Section: A**

**Write your answers in the space provided. Give non-exact numerical answers correct to 2 decimal places unless a different level of accuracy is specified in the question.**

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| **Q1:** | a)  As part of a regular health screening exercise, a group of **10** students had their weight measured. The weights (in kg) are shown in Table A1.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | 40.4 | 42.8 | 57.5 | 47.4 | 71.1 | | 46.9 | 40.9 | 71.6 | 47.2 | 68.5 |   Table A1: Weights of students (in kg)                   i.         Calculate the mean weight.                ii.         Calculate the median weight.               iii.         Calculate the range of the weights. | **Mark (5)** |
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| **Q2:** | b)     In the coming annual school sports day, students are given the choice of participating in either track events or field events, or both. Some students could not participate in either events due to medical conditions.  The participation choices of **20** students from a class is summarised in the Venn diagram in Figure A2. A denotes the event ‘student chooses track events’, B denotes the event ‘student chooses field events’, and S denotes the sample space.  C:\Users\17046589\AppData\Roaming\Republic Poly\eQuest\_assessmentimages\_assessmentimg_-676363808_-909390468.png  Figure A2: Choice of participation of 20 students in sports day events                 i.         Given that 12 students chose to participate in track events, how many students from the class chose to participate in **both** track and field events (that is, compute the value of *x*)?                ii.         If one student is randomly chosen, what is the probability that the student chose to participate in field events **only**?               iii.         Are events A and B mutually exclusive? Explain. | **Mark (5)** |
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|  | Word Count: 41 | Max Words: 8000 |

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**Section: B**

**Write your answers in the space provided. Label your answers to each part clearly. Give non-exact numerical answers correct to 3 decimal places unless a different level of accuracy is specified in the question.**

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| **Q3:** | A manufacturing firm produces a particular mechanical component with a 5% defect rate. All manufactured components go through quality inspection. For a defective component, there is a 96% chance that it does not pass quality inspection. For a non-defective component, there is a 94% chance that it passes quality inspection. A probability tree diagram in Figure B1 illustrates this scenario.  C:\Users\17046589\AppData\Roaming\Republic Poly\eQuest\_assessmentimages\_assessmentimg_681137443_1467752967.png  Figure B1: Probability tree diagram  The following are the symbol denotation of events:         D denotes the event ‘a randomly chosen component is **defective**’.         D ' denotes the event ‘a randomly chosen component is **non-defective**’.         I denotes the event ‘a randomly chosen component **passes** quality inspection’.         I ' denotes the event ‘a randomly chosen component **does not pass** quality inspection’.  a)             State the values of *m* and *n*.  b)             State the interpretation (meaning) of *m* and *n*.  c)              Calculate the chance that a randomly chosen component is defective **and** does not pass quality inspection.  d)             Calculate the chance that a randomly chosen component **passes** quality inspection.  e)             **Given that** a randomly chosen component **passes** quality inspection, what is the chance that it is **non-defective**? | **Mark (10)** |
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**Section: C**

**Write your answers in the space provided. Label your working and answer to each part clearly. Give non-exact numerical answers correct to 2 decimal places unless a different level of accuracy is specified in the question.**

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| **Q4:** | The probability distribution of a random variable *X* is shown in Table C1. *X* can only be 3, 4 or 5.   |  |  |  |  | | --- | --- | --- | --- | | ***x*** | 3 | 4 | 5 | | **P(*X* = *x*)** | 0.27 | 0.42 | *q* |   Table C1: Probability distribution of random variable *X*  a)             Is *X* a discrete or continuous random variable? Explain.  b)             State the value of *q*.  c)              What is the expected value of *X* (that is, E(*X*))?  d)             Given that E(*X*2) = 16.9, compute the variance of *X*.  In a television game show, two contestants are pitted against each other in which they answer to general knowledge questions posed to them. One point is awarded for each correct answer and there are no penalties for incorrect answers. The first contestant to receive 3 points wins the round. The total number of points awarded in each round are either 3, 4 or 5, which correspond to points score line of 3-0, 3-1 and 3-2, respectively.  The winner of each round will earn a prize money of $300 for a points score line of 3-0, $200 for a points score line of 3-1, and $100 for a points score line of 3-2. In addition, each contestant will earn $50 for each point, regardless of whether he or she is the winner of that round or not. Based on past runs, the probability distribution of the total number of points awarded in each round is shown in Table C1, where *X* is the random variable representing the **total number of points** awarded in one particular round of the game show.  e)             What is the expected amount of prize money to be given away in each round by the game show organiser? Show your working clearly. | **Mark (10)** |
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**Section: D**

**Write your answers in the space provided.** **Label your working and answer to each part clearly. Give non-exact numerical answers correct to 3 decimal places unless a different level of accuracy is specified in the question.**

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| **Q5:** | A telecommunication company set up an office to handle customer service via phone calls. Based on past records, 70% of the calls are for technical support, while the others are non-technical in nature.  In this question, we define a **binomial** variable *X* as the number of phone calls for technical support out of 10 phone calls.  a)             State one condition, in context, for *X* to be defined as a binomial variable.  b)             Out of 10 phone calls received by a customer service staff,                          i.         what is the probability that 5 of them are for technical support?                         ii.         what is the probability that **more than** 8 of them are for technical support?                        iii.         what is the mean number of phone calls for technical support?  c)              There are 5 staff handling customer service phone calls. Assuming each staff receives 10 phone calls in a particular period, what is the probability that **not more than** 2 of them receives **more than** 8 phone calls for technical support? Show your working clearly. | **Mark (10)** |
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|  | Word Count: 66 | Max Words: 8000 |

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**Section: E**

**Write your answers in the space provided. Label your answer to each part clearly. Give non-exact numerical answers correct to 3 decimal places unless a different level of accuracy is specified in the question.**

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| **Q6:** | a)     The number of views of a web page follows a **Poisson** distribution with a mean of 1.6 per minute.                  i.         What is the standard deviation of the number of views of the web page in one minute?                ii.         What is the chance that there are **at most** 3 views of the web page in a 5-minute period? | **Mark (4)** |
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| **Q7:** | b)     State one difference between Poisson and exponential distributions. | **Mark (1)** |
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| **Q8:** | c)     The time (in minutes) between two successive views of the web page is modelled as an **exponential** variable, defined as *Y* in this question.                  i.         State the parameter value of the exponential variable *Y*.                ii.         After one particular view of the web page, what is the chance of the next view occuring **within** one minute?               iii.         Calculate the variance of the exponential variable *Y*. | **Mark (5)** |
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**Section: F**

**Write your answers in the space provided. Label your working and answer to each part clearly. Give non-exact numerical answers correct to 3 decimal places unless a different level of accuracy is specified in the question.**

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| **Q9:** | The weight of male students from a school are **normally distributed** with a mean of 58 kg and a standard deviation of 7 kg.    a)             If one male student is randomly chosen, what is the chance that he weighs between 55 to 65 kg?  b)             If one male student is randomly chosen, what is the chance that he weighs more than 60 kg?  c)              If 20% of male students weigh below *c* kg, what is the value of *c*? | **Mark (6)** |
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| **Q10:** | Let *W* denote the **sum** of weights of **15** randomly chosen male students from the school.  d)             State the parameter values of normal variable *W*.  e)             The weight limit of the school lift is 900 kg. If 15 randomly chosen male students enter the lift, what is the chance that the lift’s weight limit would be **exceeded**? Show your working clearly. | **Mark (4)** |
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|  | Word Count: 27 | Max Words: 8000 |

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