Assignment 1
Due on 28th Feb, 11 p.m.

1. State whether each of the following observations is an example of discrete or continuous data:

1.1) **(5 points)** The number of car incidents in a city

1.2) **(5 points)** The concentration of lead in a sample of water

1.3) **(5 points)** The length of time that a cancer patient survives after diagnosis

1.4) **(5 points)** The number of previous miscarriages an expectant mother has had

2. **Canadian cigarettes**: The declared concentrations of tar and nicotine for 35 brands of Canadian cigarettes are shown below. The values represent milligrams per cigarettes:

Brand	tar	nicotine	Brand	tar	nicotine	Brand	tar	nicotine
Brand1	3	0.3	Brand13	8	0.9	Brand25	16	1.3
Brand2	14	1.2	Brand14	12	1.3	Brand26	11	1.0
Brand3	16	1.3	Brand15	13	1.2	Brand27	16	1.3
Brand4	10	1.0	Brand16	15	1.3	Brand28	16	1.3
Brand5	18	1.4	Brand17	12.9	0.89	Brand29	19	1.4
Brand6	13	1.2	Brand18	16	1.2	Brand30	10	1.1
Brand7	1	0.1	Brand19	17	1.3	Brand31	16	1.2
Brand8	10	0.9	Brand20	4	0.4	Brand32	16	1.2
Brand9	16	1.3	Brand21	13	1.1	Brand33	9	1.0
Brand10	13	1.1	Brand22	3	0.4	Brand34	4	0.5
Brand11	15	1.2	Brand23	1	0.2	Brand35	0.7	0.09
Brand12	12	1.0	Brand24	13	1.1			

2.1) **(5 points)** Produce a boxplot of the declared concentrations of tar per cigarette.

2.2) **(5 points)** Describe the distribution of values.

2.3) **(5 points)** Construct a scatter plot of the concentration of tar versus the concentration of nicotine. Label the axes appropriately.

2.4) **(5 points)** Does there appear to be relationship between these two quantities?

3. **Rolling an unusual die**: Li Lei has a peculiar pair of four-sided dice. One is in red colour, and the other is in blue colour. When he rolls the dice, the probability of any particular outcome is proportional to the sum of the results of each die. All outcomes that result in a particular sum are equally likely.

   3.1) **(5 points)** What is the sample space for rolling the dice?

   3.2) **(7.5 points)** Let event $\boldsymbol{A}$ = { the sum of the two dice is 8 }, what is $P(A)$?

   3.3) **(7.5 points)** Let event $\boldsymbol{B}$ = { the sum of the two dice is odd }, what is $P(B)$?

4. **(10 points) Dating**: Han Meimei and Li Lei have a date at a given time, and each will arrive at the meeting place with a delay between 0 and 1 hour, with all pairs of delays being equally likely. The first to arrive will wait for 15 minutes and will leave if the other has not yet arrived. What is the probability that they will meet?

5. **Archery**: Let's revisit the archery example in the lecture. The target board is shown at the end of the document. It consists of 10 co-centred circles. The radius of the inner-most circle is 0.1, and the radius of the outer-most circle is 1. The circles are equally spaced, i.e. the distance between any two consecutive circles is 0.1. The score you will get when your arrow hits any particular ring is indicated below. Assume you are quite skilled, and you will always shoot on target. In addition, you can place the arrow uniformly on the target board (i.e., the probability of the arrow falling in a given region is proportional to its area). Answer the following questions:

   5.1) **(5 points)** What is the probability of getting a score of 10 when you randomly shoot once?

   5.2) **(5 points)** What is the probability of getting a score of 1 when you randomly shoot once?

   5.3) **(10 points)** What is the average score you will get if you shoot the target board randomly for a large number of times?

5.4) **(10 points)** You friend is twice more likely to shoot in the right half of the target board than in the left half. Across each half, the arrow falls uniformly in that region. Answer questions 5.1) and 5.2) for your friend's shooting.