Solutions to logic puzzles.

Knights, Knaves, and Tourists.

1. Tourist. A knight would say that he is a knight, and a knave would not say that he is a knave.
2. Sam cannot be a knave, because then he would not say that at least one is a knave. So Sam is a knight. He is telling the truth, so Bob must be a knave.
3. Tom can't be a knight, because then he would not answer that there are none. Tom is a knave. So the answer "none" is incorrect, therefore there are either one or two knights among them. Now, George can't be a knave, because then the correct answer would be "one," but George can't be right. So George is a knight, "one" indeed the correct answer, thus Betty is a knave.
4. There can't be any knaves in the room, as a knave would not say that there is a knave there. Now, there can't be any knights, as a knight would have to say the truth. Therefore, they are all tourists (all telling a lie).
5. They can't be all knaves, as then the statement would be correct. So there is at least one knight. This one knight is telling the truth, so the rest of them are indeed knaves. Thus there are 19 knaves.
6. Cen cannot be a knight because a knight wouldn't say he is a tourist. Also, Den cannot be a knight because if he were, his statement would have to be correct, but there is only one knight in the group. So Ben is a knight. Therefore Ben's statement is correct. Then Cen is a knave and Den is a tourist.
7. Suppose there is a knight at the table. Then one if his neighbors is a knight and the other is a knave. The one that is a knight has a knave on his other side. Since knaves can't say the truth, both neighbors of this knave are knights. So we have the following sequence so far:
   ..., Knave, Knight, Knight, Knave, Knight, ...
   Continuing in this fashion, we see that the pattern must be two knights followed by one knave, but this is impossible with seven people sitting around a table. So they are all knaves.
8. It can't be Ronald, as then Ronald would be a knight and tell the truth, but he stated that Archibald had killed the dragon. It cannot

be Archibald, as then Ronald would be a knave, and would not tell the truth. So it must be Donald who was a knight and had killed the dragon. The other two were knaves then.

9. Jon's statement implies that Jim is a knave (because if Jim was a knight and Jon was a knight, then Jim would not claim that Jim was a knave, and if Jim was a knight and John was a knave, Jim would indeed claim that Jon was a knave, but Jon wouldn't tell the truth). Now, Jim's statement is false, so Joe is not a knave. That is, Joe is a knight. Finally, Joe's statement implies that Jon is a knave.

10. Let's see if the first one can be a knight. If his/her answer "none" is correct, then the other two are knaves, and the answer "one" that the second islander gave is correct. This is impossible. So the first one is a knave, thus there is at least one knight among the second and the third islanders. So, if the second one is a knave, then the third one must be a knight, but then the answer "one" that the second islander gave would be correct, which is impossible. So the second islander is a knight. The answer "one" is indeed correct, so the third one is a knight also. So the third one must have answered "one" as well.

11. If Bin were a knight, Tim would have to ba a knave. Then Kim would be a knight. But Kim's statement that both Bin and Tim are knaves would be wrong. so this is impossible. Therefore Bin is a knave. So Tim is a knight, and Kim is a knave. Then Sim is a knight.

12. No. If the population of the island were an odd number, then there would be either an even number of knights and an odd number of knaves, or an odd number of knights and an even number of knaves. In the first case, both statements are correct, which is impossible since the knaves would not give a correct statement. In the second case, both statements are incorrect, which is also impossible, as the knights would not give an incorrect statement.

13. The man in red cannot be the tourist because then both statements said by the men in blue and green would be true, but one of them is a knave. Therefore both the man in blue and the man in green are lying, so neither of them is the knight. Thus the man in red is the knight, and his statement that the man in green is the tourist is correct. Then the man in blue as the knave.

Various puzzles about true and false statements.

1. No. While Pete's cat necessarily sneezes 24 hours before each rainstorm, it may sneeze at other times as well.

2. Brown does not have black hair, so he must have red hair. Then Black has brown hair, and Red has black hair.

3. Between Bill's statement and Don's statement exactly one must be true. So the other two statements are false. Since Charlie's statement is false, Charlie is the guilty man.

4. Statement B cannot be true as none of them has a day when they tell the truth but lie on both the previous and the following days. However, there is not a day when both of them lie, so statement A is true. Therefore statement A is said either by Tweedledum on Wednesday or by Tweedledee on Sunday. On Sunday though each of them says truth, so it must be Wednesday. Statement A is said by Tweedledum, and statement B is said by Tweedledee.

5. Statement (c) implies (a), (b), and (d), so if exactly three of the statements are true, then (c) must be false. Now, (a) must be true, as if (a) were false, (e) would have to be false as well, and then at most two statements would be true. So it was not a draw, but North did not win, so North lost. Therefore (d) is false, while (a), (b), and (e) are true. Now we have that North scored one of three goals, but lost, so the score was 2-1.

6. If n is divisible by 55, then it would be divisible by 5 and 11. So "n is divisible by 55" must be false. It can't be the case that both "n is divisible by 5" and "n is divisible by 11" are true as then n would have to be divisible by 55. Also, it can't be the case that "n is divisible by 11" and "n is less than 10" are true since n has to be positive. So it's the first and last statements that have to be true, thus $n = 5$.

7. Since the boy tells the truth on Thursdays and Fridays, he should give the same name on two consecutive days. In the given list no name appears on two consecutive days, so the missing day should be either a Thursday or a Friday. If the missing day is a Friday, then his last answer (Bob) was on a Thursday. However, then on Tuesday he also said Bob, which is impossible since he lies on Tuesdays. So the missing day must be a Thursday. Then, the first day he when he was asked was a Friday, and he said John. So his name is John, and that will be his answer on the seventh day (Thursday).

8. Consider the two possibilities in the first statement: either Ka or Ga won. If Ka won, then the second statement implies that Ga was not second (as we know Roo did not win since Ka did). So Ga was third. But then the third statement says that Ka did not win, and we have a contradiction. Therefore Ga won. Now the fourth statement says that

Roo came in second. Thus Ka finished third.

9. 27. They cant's be all lying as then they would all have 7 heads and have 28 heads total. This is impossible as one of them said they had 28 heads. So at least one of them is saying the truth. However, since they all give different numbers of heads, at most one of them is saying the truth. Therefore exactly one of them is saying the truth. So three of them have 7 heads total, and the truthful one must have either six or eight heads. The total then is either 27 or 29. Since nobody said 29, the answer is 27.
10. The striped one. First, consider the green octopus. If it says the truth, then the blue octopus has 6 legs, thus must say the truth. However, the blue octopus says it has 8 legs, so that cannot be the case. Therefore the green octopus lies. Now consider the blue octopus. If it says the truth and has 8 legs, then the first statement of the purple octopus is true. So it says the truth, but then it can't have 9 legs. So this case is impossible, i.e. the blue octopus lies also. Therefore the purple octopus lies as well. Then, the first statement of the striped octopus is correct, therefore its second statement must be correct as well.

Guessing numbers.

1. Bob must have 1, since otherwise he would not know whether Crystal's number is one larger or one smaller than his. Crystal has 2 then.
2. Bob doesn't have 1, and now Crystal knows his number. She must have 2 then, and she knows that Bob has 3. If she had 1, she would know Bob's number right away, and if she had larger then 2, she would not know Bob's number after Bob's claim.
3. From Bob's first claim we know he does not have 1. From Crystal's reply we know that she does not have 1 or 2. Since Bob still doesn't know Crystal's number, he can't have 2 or 3. Finally Crystal knows Bob's number, she must have 3 or 4. If she has 3, she knows Bob's number is 4. If she has 4, she knows Bob's number is 5. Since she says that Bob's number is odd, it must be 5. So Crystal has 4.

Knights, Knaves, and and their language.

1. To find out what the words mean, without knowing if the fellow is a knight or a knave, you ask, "are you a knight?" Either way, they will say "yes," so whichever word they use is the affirmative one.
2. To find out if the fellow is a knight or knave, you ask him, "does ja

mean yes?" If he says "ja," he is a knight. If he says "da," he is a knave.

Interestingly enough, to find out if the person is a knight or a knave, you ask what the words mean, and to figure out what the words mean, you ask if the person is a knight. The person's response, though it does not answer your question, gives you information.

3. To determine the correct path, ask the person standing at the fork in the road this question: "If I were to ask you if this path leads to freedom, would you say 'ja'?" If the person says "ja," it is the path to freedom. If he says "da," it's the path to certain death.

   To see why this is true, let's first assume the person is a knight. There are four additional possibilities:

   "Ja" means "yes" and the path leads to freedom. Knight's response: "ja." "Ja" means "yes" and the path leads to death. Knight's response: "da." "Ja" means "no" and the path leads to freedom. Knight's response: "ja." "Ja" means "no" and the path leads to death. Knight's response: "da."

   This trick works because, regardless of whether "ja" means "yes" or "no," the same word from the knight will indicate the path to freedom, and the opposite word will indicate a path to death. If you ask the knight, "If I were to ask you if this path leads to freedom, would you say yes?" and the path does lead to freedom, then he would say "yes" (or his word for it. Likewise, if you asked, "If I were to ask you if this path leads to freedom, would you say no?" and it does lead to freedom, the knight's response would be "no" (or his word for it).

   With the knave, the same question works in the same way. The key here is the first part of the question: if I were to ask you. This tricks the knave into giving you the same responses as the knight. For example, if the path led to freedom, and you asked a knave if it leads to freedom, he would say "no." But if you ask, "if I were to ask you if this path leads to freedom, would you say yes?" then he would say "yes" (which is a lie, because he would not say "yes" if you were to ask him).

   With this in mind, the four possibilities for the knave are the same as with the knight. Notice that you can figure out which path is the path to freedom without knowing if the person is a knight or a knave, and without determining the meanings of "da" and "ja."