2016(平成28)年度　環境情報学部　一般入学試験問題　訂正

教科・科目	ページ	設問	誤	→	正
数学 または 情報 (数学)	3	I	1行目　問題冒頭部分 数学－I	→	数学－I 以下の設問ではボールを取り出しても確率αは変化しないものとする。
数学 および 外国語 (数学)	17	III	1行目　問題冒頭部分 III	→	III 以下の設問ではボールを取り出しても確率αは変化しないものとする。
外国語	20	英語 III	第16段落 [77] (1. dividing and conquering 3. ducking and covering　3. twisting and turning).	→	第16段落 [77] (1. dividing and conquering 2. ducking and covering　3. twisting and turning).

I. 次の文章に関して、空欄補充問題と読解問題の二つがあります。まず、[1]から[10]の空所を埋めるのに、文脈的に最も適切な語を 1 から 3 の中から選び、その番号を解答欄 (1) から (10) にマークしなさい。次に、内容に関する[11]から[15]の設問には、1 から 4 の選択肢が付されています。そのうち、文章の内容からみて最も適切なものを選び、その番号を解答欄 (11) から (15) にマークしなさい。

1 Rosie, C-3PO, HAL, WALL-E, Bender, Optimus, Asimo. We have envisioned building humanoid machines with the ability to walk, talk and think like us—or better than us—since long before the creation of the microchip.

2 But here's the thing—humanoid robots are never going to happen. To understand why, you have to understand the shape of the technical problems and compare them to market [1](1. caps 2. forces 3. locations).

3 First, the mechanics of the human body are spectacularly complex. Sure, we have built machines [2](1. for 2. on 3. with) arms and legs, but we are a long way from having a unified platform that can walk the Earth with the [3](1. demonstrability 2. integrity 3. dexterity) and reliability of a human.

4 Second, we need major advancements in input/output software. Anyone who's gotten into an argument with his smartphone can well understand how far we are from having a dependable [4](1. conversation 2. debate 3. lecture) with a machine. It's amusing, if frustrating, to ask one's phone to "Send Jenn a text" and hear it reply, "What song would you like me to play?" Speaker-independent, open-ended speech [5](1. breakdown 2. recognition 3. recording) with better than 99 percent reliability isn't part of our near future.

5 Third, artificial intelligence is the biggest software challenge in the universe. The human brain's ability to process information and learn and make decisions is something we can barely understand, [6](1. let alone 2. never to 3. only to) reproduce. Reproducing human thought in a controlled situation—like the game of chess—is barely within our grasp. Software that enables machines to act like us, which requires them to think like us, isn't something we'll be able to develop for generations, if ever.

6 So all we have to do to build a humanoid robot is build a machine to replicate the human form. Then solve the input/output problem so we always understand each other. And finally, replicate the thought process of the human brain. Any one of those three tasks is [7](1. frequently 2. nearly 3. undeniably) impossible. The combination of all three represents one of the greatest technical challenges known to man.

7 However, it's not just the scale of the technical challenge that makes a humanoid robotic future impossible; it's the intersection of those three challenges with simple economics.

8 A humanoid robot would be a multipurpose [8](1. pedestal 2. platform 3. stage) that could do almost anything. It could do things like get a drink from the fridge or a newspaper from the front door. But those are sub-$20 problems—meaning realistically you wouldn't pay $20 for someone to solve those problems for you. That same humanoid robot could do more useful things like vacuum your house or [9](1. grow 2. replace 3. soothe) your baby or drive your car. Those things are worth more than $20 and we already use robots to solve those problems—they just aren't humanoid.

9 You can pay $400 for a robot that vacuums your house. For around $250 you can buy an infant seat to rock your baby. When buying a new car you can select robotic options on the fringe of self-driving technology, like lane departure warning and collision avoidance and dynamic cruise control.

10 The point is, we don't need to build a humanoid robot to do these things. We can build the robots into the things themselves.

11 The idea that we'll have robots in the future to assist in daily tasks isn't wrong. The idea that we need a multipurpose humanoid robot is. As costs continue to [10](1. increase 2. decline 3. soar) and technology continues to advance, we'll be able to make lots of special-purpose robots to solve real consumer problems. There's just no need to make them humanoid.

—Based on Daley, R. (January 2015). The robots are coming—Aren't they? *TechCrunch.*

[11] In the 1st paragraph, why does the author make a list of robots?

1. To show people's fascination with humanlike robots over many years.
2. To show the great diversity of opinion about robots in society.
3. To set up the target at which modern robotics is aiming.
4. To represent both the good and bad prospects of robots.

[12] In the 4th paragraph, what is the purpose of mentioning arguing with phones?

1. To demonstrate how much fun robots can be.
2. To show that effective artificial intelligence is many years away.
3. As an example of the great strides forward we have made in robotics.
4. As a cautionary tale of the dangers of giving machines the power to think.

[13] What is a "sub-$20 problem," as mentioned in the 8th paragraph?

1. Problems of a domestic variety, such as raising children, and cleaning homes.
2. Problems for which very cheap humanoid robots may one day be developed.
3. Problems which people frequently spend around 20 dollars to solve.
4. Problems that people don't mind solving for themselves.

[14] What is true about the author's opinion of robots?

1. Robot development is a waste of time, money, and effort.
2. Robots are useful, but not in the form traditionally imagined.
3. Within a few generations, robots may look and act like people.
4. None of the things that robots can do are actually needed or wanted.

[15] Which of the following is ***NOT*** a reason to doubt the development of humanoid robots?

1. The complicated nature of human bodies.
2. Limitations in technology.
3. Lack of public interest.
4. Financial restrictions.

II. 次の文章に関して、空欄補充問題と読解問題の二つがあります。まず、[16]から[25]の空所を埋めるのに、文脈的に最も適切な語を 1 から 3 の中から選び、その番号を解答欄 (16) から (25) にマークしなさい。次に、内容に関する[26]から[30]の設問には、1 から 4 の選択肢が付されています。そのうち、文章の内容からみて最も適切なものを選び、その番号を解答欄 (26) から (30) にマークしなさい。

1 A nanoparticle is one billionth of a metre; it might be hard to appreciate how small that is, but Australian virtual nanoscientist Amanda Barnard understands this "invisible" world. So it's no [16](1. excuse 2. doubt 3. wonder) that today the Foresight Institute announced Amanda as this year's awardee of the prestigious 2014 Feynman Prize for Nanotechnology Theory—it's like the Nobel Prize of the nanoscience world. Not only is Amanda the first Australian in the Prize's 22-year history to win the award, she's also the first woman, shining a much-needed spotlight on the achievements of women in science. The award is named after Richard Feynman, a renowned physicist and Nobel Prize winner from last century: the father of quantum electrodynamics.

2 Amanda's award winning work required the use of powerful supercomputers to make the [17](1. least 2. most 3. whole) of decades of big data on tiny nanoscience, gaining insights that might one day lead to extraordinary, life-changing products. We're thinking: self-cleaning surfaces, fuel cells for harnessing energy, printable inks that conduct electricity, and new drugs to cure life-threatening illnesses. These are just some of the incredible possibilities.

3 Just a few years ago, Amanda made a fundamental discovery on diamond nanoparticles, finding that they have unique electrostatic properties that make them spontaneously arrange into very useful structures, with huge implications for improving healthcare.

4 Already, her diamond discovery has [18](1. underpinned 2. understood 3. undertaken) the development of a potentially life-saving chemotherapy treatment that targets brain tumours, created by the University of California.

5 Among her other research highlights, Amanda developed a new technique for investigating the shape of nanomaterials including their size, temperature or potential uses in chemistry. This means we can [19](1. tailor 2. dress 3. sew) them to make custom-made nanoparticles targeted to specific application areas.

6 Before Amanda [20](1. sends 2. sets 3. stands) off for California next month to pick up her award, she shared with us some more insights about her work at the nanoscale.

7 ***What do you enjoy most about your job?***

8 I enjoy our current move into big data. Going into big data-sets to identify trends between nano properties and structures is like finding buried treasure. It's exciting when you can see the forest for the [21](1. birds 2. grass 3. trees) and get a moment of clarity when all the data collects. Those moments are really interesting and I look forward to having more of them. I also love that science is reinventing itself all the time. It never becomes complacent and will always be exciting as it continually [22](1. devolves 2. evolves 3. revolves). One finding always leads to another question.

9 ***How does your work impact on product design and development?***

10 I use statistics to determine how well certain tiny material structures will perform under specific conditions. By predicting how imperfections at a molecular level impact on performance, we can design products with less [23](1. adaptability to 2. responsibility for 3. susceptibility to) faults from the outset. We can also design "molecular machines" that can perform more familiar tasks, like cogs in a watch; they are an [24](1. integral 2. interpreted 3. interested) component that can enhance or improve products.

11 ***What would you say has been the highlight of your career so far?***

12 This prize is definitely a career highlight and I'm thrilled! This would have to be up there as a career highlight for anybody working in nanotechnology.

13 ***What is the biggest challenge you're grappling with at the moment?***

14 Implementing our science on the cloud is the biggest technical challenge for us at the moment. The data is so big and the skillset is so new and so specific. The cloud would provide easy open access to results amongst our research peers and we need to do this to collaborate and make the most of all the research data that's available.

15 ***Where would you like to see your research /science go or lead to in future?***

16 I don't want to know. I hope I'm not able to predict where science goes, [25](1. nevertheless 2. otherwise 3. rather), I want to be surprised by where it takes us next, and enjoy the ride.

—Based on Hawley, J. (April 2015). Nanotech prize: No small win for Australia and women in science. *News @ CSIRO.*

[26] Based on the information in the article, which of the following is the most likely product to result from Amanda Barnard's research?

1. More cost-effective cloud computing.
2. A bathtub that doesn't need washing.
3. Cures for conditions such as colds, hay fever, and headaches.
4. Batteries that never need replacing or recharging.

[27] What is meant by "buried treasure" in the 8th paragraph?

1. Awards and accolades, such as the Nobel and Feynman prizes.
2. Curing harmful diseases and improving product effectiveness.
3. Hard-to-find meaning in large amounts of information.
4. Working with colleagues through the cloud.

[28] Which of the following is ***NOT*** true according to the article?

1. Amanda Barnard loves science because it is predictable.
2. Cloud computing is important, but poses specific problems.
3. In the past, the size of data-sets made making discoveries difficult.
4. Medical advances have already been made due to nanoparticle research.

[29] The tone of this article can be said to be

1. humorous and dismissive.
2. optimistic and laudatory.
3. pessimistic and critical.
4. dry and technical.

[30] "Molecular machines," mentioned in the 10th paragraph, can be compared to

1. simple but important parts of complex mechanisms.
2. supercomputers that can sift through enormous amounts of data.
3. design programs that improve product durability and functionality.
4. quality inspectors that automatically identify material imperfections.

III

(1)　A, B, C, D の 4 つの箱があり，A の箱には 7 個の黒ボールと 3 個の白ボールが入っている．B, C, D の箱にも黒ボールと白ボールが入っていて，どの箱においても 1 個を無作為に取り出したときに黒ボールである確率は α である $(0 < \alpha < 1)$．また，少なくとも 3 個以上のボールがそれぞれの箱には入っている．このとき，B, C, D の箱からそれぞれ 3 個のボールを無作為に取り出し A の箱に加えた後，A の箱から 1 個のボールを無作為に取り出したときにそれが黒ボールである確率は

$$\frac{\boxed{(61)}\boxed{(62)}}{\boxed{(63)}\boxed{(64)}} + \frac{\boxed{(65)}\boxed{(66)}}{\boxed{(67)}\boxed{(68)}}\alpha$$

である．

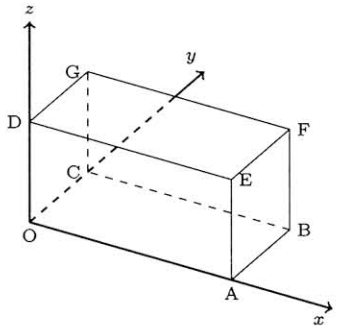
(2)　E, F, G, H の 4 つの箱があり，E の箱には 7 個の黒ボールと 3 個の白ボールが入っている．F, G, H の箱にも黒ボールと白ボールが入っていて，どの箱においても 1 個を無作為に取り出したときに黒ボールである確率は α である $(0 < \alpha < 1)$．また，少なくとも 3 個以上のボールがそれぞれの箱には入っている．このとき，まず，E と F の箱からそれぞれ 3 個のボールを無作為に取り出し交換してもとの箱に戻し，次に，E と G の箱からぞれぞれ 3 個のボールを無作為に取り出し交換してもとの箱に戻し，次に，E と H の箱からぞれぞれ 3 個のボールを無作為に取り出し交換してもとの箱に戻した後，E の箱から 1 個のボールを無作為に取り出したときにそれが黒ボールである確率は

$$\frac{\boxed{(69)}\boxed{(70)}\boxed{(71)}\boxed{(72)}}{10000} + \frac{\boxed{(73)}\boxed{(74)}\boxed{(75)}}{1000}\alpha$$

である．

IV

図のような O(0,0,0)，A(2,0,0)，B(2,1,0)，C(0,1,0)，D(0,0,1)，E(2,0,1), F(2,1,1), G(0,1,1) を頂点とする直方体を，平面 $x+y+z=a$ $(1<a<3)$ で切断したとき，その断面の面積 S は



$$\frac{\sqrt{\boxed{(76)}}}{\boxed{(77)}}\left(\boxed{(78)}\boxed{(79)}a^2+\boxed{(80)}\boxed{(81)}a+\boxed{(82)}\boxed{(83)}\right)$$

となる．

また，切断した断面の各頂点と O(0,0,0) を結んでできる角錐の体積 V は，$a=\dfrac{\boxed{(84)}+\sqrt{\boxed{(85)}\boxed{(86)}}}{\boxed{(87)}}$ のときに最大になる．このとき，$V=\dfrac{\boxed{(88)}\boxed{(89)}+\boxed{(90)}\boxed{(91)}\sqrt{\boxed{(92)}\boxed{(93)}}}{\boxed{(94)}\boxed{(95)}}$ である．

V

ある人が破産したとき，すなわち，借りているお金の一部分しか返すことができなくなったとき，その人の財産 (現在残っているものをお金にしたもの) の総額 A を n 人の債権者 (お金を貸した人) にどう分配するかについて考える．債権者には債権額 (貸したお金の額) の少ない順に番号が振られており，第 i 番目の債権者の債権額を B_i とすると，$B_i < B_{i+1}$ $(i = 1, \ldots, n-1)$ が成り立っている．また，$B = \sum_{i=1}^{n} B_i$ としたとき，$A < B$ である．以下では $A = B$ のときを含めて，第 i 番目の債権者の分配額 X_i を，B_i の状況に応じて，次のルールに従って決める．

ケース 1: $A \leqq \dfrac{n}{2} B_1$ のときは，$X_i = \dfrac{1}{n} A$ $(i = 1, \ldots, n)$ とする．

ケース 2: $1 \leqq k \leqq n-1$ に対して

$$\frac{1}{2}B - \frac{1}{2}\sum_{j=k}^{n}(B_j - B_k) \leqq A \leqq \frac{1}{2}B - \frac{1}{2}\sum_{j=k+1}^{n}(B_j - B_{k+1})$$

のときは

$$X_i = \begin{cases} \dfrac{1}{2}B_i & (i = 1, \ldots, k) \\ \dfrac{1}{2}B_k + \dfrac{1}{n-k}\left\{A - \dfrac{1}{2}B + \dfrac{1}{2}\displaystyle\sum_{j=k}^{n}(B_j - B_k)\right\} & (i = k+1, \ldots, n) \end{cases}$$

とする．

ケース 3: $1 \leqq k \leqq n-1$ に対して

$$\frac{1}{2}B + \frac{1}{2}\sum_{j=k+1}^{n}(B_j - B_{k+1}) \leqq A \leqq \frac{1}{2}B + \frac{1}{2}\sum_{j=k}^{n}(B_j - B_k)$$

のときは

$$X_i = \begin{cases} \dfrac{1}{2}B_i & (i = 1, \ldots, k) \\ B_i - \dfrac{1}{2}B_k - \dfrac{1}{n-k}\left\{\dfrac{1}{2}B + \dfrac{1}{2}\displaystyle\sum_{j=k}^{n}(B_j - B_k) - A\right\} & (i = k+1, \ldots, n) \end{cases}$$

とする．

ケース 4: $B - \dfrac{n}{2} B_1 \leqq A$ のときは，$X_i = B_i - \dfrac{1}{n}(B - A)$ $(i = 1, \ldots, n)$ とする．

(1)　$n=2,\ B_1=60,\ B_2=180$ としたとき，A が (96)(97)(98) $\leqq A \leqq$ (99)(100)(101) の範囲ならば，$X_1=30$ となる．また，X_2 が X_1 の 4 倍となるのは，A の値が 2 通りあり，小さい順に (102)(103)(104) と (105)(106)(107) の場合である．

(2)　$n=3,\ B_1=60,\ B_2=90,\ B_3=180$ としたとき，$A=100$ ならば，$X_2=$ (108)(109)(110)，$X_3=$ (111)(112)(113) であり，$A=220$ ならば，$X_2=$ (114)(115)(116)，$X_3=$ (117)(118)(119) である．