RLP-AIDA · RLP AI Design A — Machine Learning, Media and the Human Body

Unit 4: Signals and Diagnosis: Visualizing Vital Signs and Medical Data

Practice Workbook. The same problems, in the same order, as the Practice sections of the online lessons.

Name _____ Period _____

Lesson 4.1 — Data Portraits: Du Bois, Einthoven and the Art of the Signal

FLUENCY

1. Name the four routine vital signs, and the extra measurement many settings also take.

2. An invented example person, Sam, has a blood pressure reading of 116/74 mm Hg. Which number is systolic, which is diastolic, and what does each measure?

3. Who was Willem Einthoven, what letters did he give the ECG waves, and when did he receive the Nobel Prize?

APPLICATION

4. Using the lesson's method (count for 15 seconds, multiply by 4), find the heart rate for invented example people who count (a) 18 beats, (b) 16 beats, (c) 25 beats. Which fall within the adult resting range MedlinePlus gives?

5. Why does the lesson say to use two fingers and not the thumb when counting a pulse? Name the two places it gives for finding a pulse.

6. Apply the lesson's four questions for any data image to Du Bois's 1900 charts: who collected the data and why, who was the audience, what was emphasized, and what feeling the design creates.

7. In films and logos a spiking line means 'alive'. In 2-3 sentences, explain how the ECG trace became a cultural symbol and whether that symbol matches what an ECG actually measures.

REVIEW

8. Review 2.1: Du Bois's charts bend bars into curves when they run out of space. Like Priestley's chart, his charts have a point of view. What does the lesson say every timeline or data image needs that point of view to be?

Lesson 4.2 — Pulse to Pixels: Coding a Heart-Rate Visualization

FLUENCY

1. In p5.js, what does setup() do, what does draw() do, and what does frameCount count?
2. Define *redundant encoding* and say which two visual variables encode heart rate in the starter sketch.
3. Compute pulses per second (bpm / 60) for 72, 96 and 98 bpm, to two decimal places.

APPLICATION

4. Using map(bpm, 40, 120, 270, 30), compute y for 70, 96 and 98 bpm. Show the fraction for each.

5. The starter sketch draws guide lines at 60 and 100 bpm. At what y values are they drawn? Why does the higher rate get the smaller y?

6. Find the mean and the median of the twelve illustrative readings: 72, 74, 71, 73, 75, 72, 70, 96, 98, 74, 73, 72. Which is more affected by minutes 8 and 9?

7. Complete a mapping table for a design that adds color: fill in data field, visual variable, range and reason for (a) position, (b) pulse speed, (c) color for readings above 90 bpm.

8. A classmate labels the two high readings 'abnormal heart' in red. Write a better label and explain why yours is more honest.

CHALLENGE

9. In the starter sketch, r = 8 + 3 * sin(TWO_PI * (bpm / 60) * t). What are the smallest and largest radius, and the smallest and largest circle diameter drawn? How many full pulses does the 96 bpm circle make in 5 seconds?

REVIEW

10. Review 1.1: Which of the three design moves from Unit 1 does a mapping table make explicit, and what is the rule for it?

Lesson 4.3 — Who Sees Your Data? Medical Records, Genetics and HIPAA

FLUENCY

1. Name the four kinds of medical data the lesson describes, with one example of each.

2. Define *covered entity*, *protected health information* and *aggregation*.

3. What does GINA (2008) restrict, and what does Missouri section 375.1303 add?

APPLICATION

4. Does the HIPAA Privacy Rule generally cover each of these? (a) a hospital's electronic health record; (b) a free fitness tracker app that works for no health provider or plan; (c) a company processing records on a hospital's behalf as a business associate.

5. An invented neighborhood case map shows 140 cases in one district and 2 cases in one city block. Identify the privacy risk and give two fixes from the lesson.

6. A presentation includes a screenshot of a real patient record with the name visible in the corner. Using the lesson, explain two problems and what the designer should have done.

7. For the de-identified scans dilemma, write Position B's strongest case (patients should be asked and able to say no) in 2-3 sentences, then restate it in one sentence a holder would accept.

CHALLENGE

8. A chart of an invented 30-member club's health survey shows one column: 'age 60+, female, rare condition: 1'. Even with no names, why is this a risk, and how would you redesign it?

REVIEW

9. Review 2.3: Using the bias checkpoint 'who is in the training data', explain why a company receiving scans from only one hospital should ask that question.

Lesson 4.4 — Imaging the Invisible: Designing a Patient Brochure

FLUENCY

1. Match each method to how it makes an image: X-ray, CT, MRI, ultrasound. Choices: echoes of high-frequency sound; a strong magnet and radio waves; X-ray measurements from many angles combined by a computer; a small dose of ionizing radiation through the body.

2. Give the person and year for each: stethoscope; mercury cuff device; the sounds used for manual systolic and diastolic readings; discovery of X-rays; first clinical CT scan.

3. List the six questions the lesson says patients ask.

APPLICATION

4. Put the six panels of a tri-fold in reading order and give the job of each, following the lesson.

5. Rewrite these brochure headings as the patient's questions: (a) 'Procedure'; (b) 'Safety information'; (c) 'Duration'.

6. A brochure about MRI says: 'MRI uses a small dose of radiation, like an X-ray.' Correct it using the lesson, and add one fact a patient should know before the scan.

7. A letter-size sheet is 11 inches wide. Folded into three equal panels, how wide is each panel to two decimal places? If body text is 11 points and 72 points make an inch, about how tall is one line of 11-point type in inches?

REVIEW

8. Review 3.1: CT builds cross-sectional images. Which anatomical view type from Unit 3 matches a CT image, and how would you illustrate it on the brochure?

9. Review 4.3: Your brochure includes an example scan image. Why should it be an openly licensed or illustrative image rather than a scan of a real, identifiable patient?

Unit 4 checkpoint

1. An invented example person counts 17 beats in 15 seconds. What is the heart rate?
   A. 17 bpm
   B. 68 bpm
   C. 75 bpm
   D. 85 bpm
2. The pressure in the arteries when the heart rests between beats is the _____ pressure.
3. True or false: Du Bois's charts show that a visualization can be precise and still have a strong visual voice and argument.
4. With map(bpm, 40, 120, 270, 30), where is 80 bpm drawn?
   A. y = 120
   B. y = 150
   C. y = 160
   D. y = 80

5. In the starter sketch, position and pulse speed both show heart rate. This is called:
   A. Redundant encoding
   B. Overfitting
   C. Aggregation
   D. Direct labeling

6. True or false: Highlighting readings in a new color tells viewers those readings matter, so the designer should be ready to say why.

7. Which is a HIPAA covered entity?
   A. A free consumer step-counting app
   B. A health plan
   C. A school club
   D. Any website that mentions health

8. HIPAA's Safe Harbor method lists _____ kinds of identifiers to remove (give a number).

9. True or false: Removing names always makes a health dataset impossible to re-identify.

10. Which imaging method builds images from the echoes of high-frequency sound waves?
    A. CT
    B. X-ray
    C. Ultrasound
    D. PET

11. A letter-size sheet folded in three makes _____ panels (give a number).

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