第二套题目：2019/2020学年

考试信息

- **模块代码**: COMP0137 / COMPGI14
- **模块名称**: Machine Vision
- **适用学年**: 2019/2020及之前注册学生
- **说明**: 考生需回答所有问题，总分100分，可使用课程幻灯片、视频、笔记及书籍等资源或在线搜索，但禁止与其他考生交流或分享答案。

Section A: A Graphical Model

Question 1
This section uses the same Markov Model as 2020/21, with five variables (X_1) to (X_5). Refer to the unary, pairwise, and triplet cost tables below.

Unary Costs

Variable	State	Cost
(X_1)	A	2
(X_1)	B	3
(X_2)	C	1
(X_2)	D	4
(X_2)	E	2
(X_3)	F	5
(X_3)	G	3
(X_3)	H	2
(X_4)	I	4
(X_4)	J	1
(X_4)	K	3
(X_5)	L	2
(X_5)	M	5
(X_5)	N	3

Pairwise and Triplet Costs

Combination	States	Cost
(X_1, X_2)	A, C	1

Combination	States	Cost
(X_1, X_2)	A, D	2
(X_1, X_2)	A, E	3
(X_1, X_2)	B, C	4
(X_1, X_2)	B, D	5
(X_1, X_2)	B, E	6
(X_2, X_3)	C, F	2
(X_2, X_3)	C, G	3
(X_2, X_3)	C, H	4
(X_2, X_3)	D, F	5
(X_2, X_3)	D, G	6
(X_2, X_3)	D, H	7
(X_2, X_3)	E, F	8
(X_2, X_3)	E, G	9
(X_2, X_3)	E, H	10
(X_3, X_4)	F, I	3
(X_3, X_4)	F, J	4
(X_3, X_4)	F, K	5
(X_3, X_4)	G, I	6
(X_3, X_4)	G, J	7
(X_3, X_4)	G, K	8
(X_3, X_4)	H, I	9
(X_3, X_4)	H, J	10
(X_3, X_4)	H, K	11
(X_4, X_5)	I, L	4
(X_4, X_5)	I, M	5
(X_4, X_5)	I, N	6
(X_4, X_5)	J, L	7
(X_4, X_5)	J, M	8
(X_4, X_5)	J, N	9
(X_4, X_5)	K, L	10

Combination	States	Cost
(X_4, X_5)	K, M	11
(X_4, X_5)	K, N	12
(X_1, X_3, X_5)	A, F, L	5
(X_1, X_3, X_5)	A, G, M	6
(X_1, X_3, X_5)	B, H, N	7

Questions:
(a) Configuration A is ACGJN. Compute the total cost of this configuration: _
[7 marks]

(b) Configuration B is AEFKM. Compute the total cost of this configuration: _
[7 marks]

(c) What is the Maximum Likelihood configuration? _ _ _ _ _
[7 marks]

(d) What is the Maximum a Posteriori configuration? _ _ _ _ _
[8 marks]

[Total for Question 1: 29 marks]

Section B: Cloud Tracking Task

Question 2
You're installing two wide-field-of-view cameras to track cloud points and infer velocity (m/s).

Questions:
(a) Choose the distance between the cameras: 0.5 m / 50 m / 500 m / 5000 m
Answer: ___
[6 marks]

(b) Select an interest-point detector: FAST / SUSAN / Canny / SIFT / DoG
Answer: ____
[6 marks]

(c) Do the cameras need to be genlocked?
Answer: **True or False?**
[4 marks]

(d) In max 4 sentences, describe how single-airplane telemetry aids this task and if multiple airplanes are needed.

[7 marks]

(e) In max 2 sentences, explain how your system handles clouds at different altitudes.

[6 marks]

[Total for Question 2: 29 marks]

Section C: Miscellaneous Questions

Question 3
In max 4 sentences, describe a computer vision classification task with 3+ severely imbalanced categories and how to address the imbalance.

[12 marks]

Question 4
In max 3 sentences, discuss if class imbalance applies to regression tasks and how to check for it.

[9 marks]

Question 5
In max 3 sentences, describe an efficient way to identify a mislabeled training example in a large-parameter model.

[9 marks]

Question 6
For each, answer “G” (Generative better), “D” (Discriminative better), “B” (Both), or “N” (Neither preferable):
6.a: Input vector (x) has missing data: __
6.b: No access to a prior: __
6.c: Access to a prior: __
6.d: Model has few parameters: __
6.e: Want to draw samples from the model: __
6.f: World-state is high-dimensional: __
[12 marks]

[Total for Questions 3-6: 42 marks]
[Total for all questions: 100 marks]

2019/20学年机器视觉考试答案

Section A: A Graphical Model

与2020/21学年相同：

- **1(a)**: 30
- **1(b)**: 44
- **1(c)**: A C G I L
- **1(d)**: A C G I L

Section B: Cloud Tracking Task

题目2

(a) 摄像机距离

立体视觉基线建议为 50 米。

答案: 50 m

(b) 兴趣点检测器

SIFT 具有尺度不变性，适合云跟踪。

答案: SIFT

(c) 是否需要genlocked

需要同步拍摄以确保立体视觉准确性。

答案: True

(d) 飞机遥测如何帮助

提供云层高度信息辅助速度计算，多架飞机提供更多视角。

答案: Airplane telemetry provides cloud altitude for velocity calculation; multiple airplanes offer diverse viewpoints.

(e) 处理不同高度的方法

使用立体视觉或深度估计。

答案: Use stereo vision or depth estimation to account for varying altitudes.

Section C: Miscellaneous Questions

题目3

任务及应对不平衡

任务：区分罕见疾病图像。方法：过采样少数类或使用加权损失。

答案: Classify rare diseases from medical images; address imbalance with oversampling or weighted loss.

题目4

回归中的不平衡及检查方法

不平衡指目标值分布不均，检查方法为绘制直方图。

答案: Yes, as skewed target distributions; check with histograms.

题目5

识别错误标签的方法

使用交叉验证检测不一致预测。

答案: Use cross-validation to identify inconsistent predictions.

题目6

(a-f) 选择

- 6.a: G
- 6.b: D
- 6.c: G
- 6.d: D
- 6.e: G
- 6.f: D