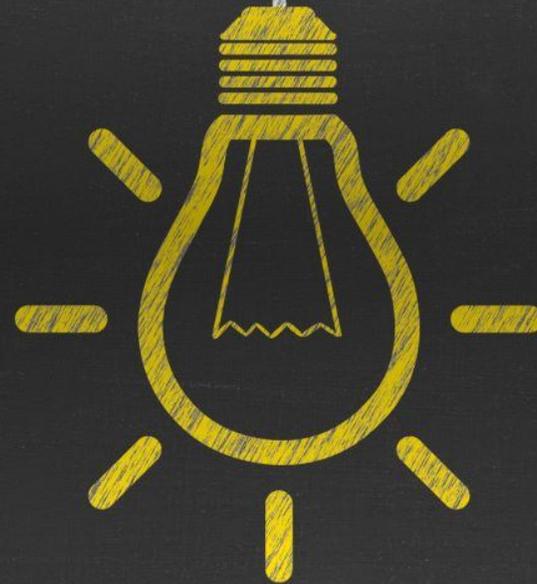


# Sharing to Summer Research

Yist

WISE@CUHK

26<sup>th</sup> March 2021



## 暑期研究从准备到结束

- 前期准备A-项目挑选
- 前期准备B-个人计划
- 日常工作
- 研究重点-偏理论的研究课题

## 研究工作的真实感受

- 个人收获
- 纠结时刻

Tips

Appendix

# Outline



Part1  
暑期研究  
从准备到结束



# 前期准备A-项目挑选

- **GPA** (Department)
- 对该学生的课堂印象
- 该学生目前掌握的知识和呈现出来的状态

- 教授的个人方向及与自我兴趣方向的贴合度
- 外界口碑：往年组内成员的评价和个人上课体验



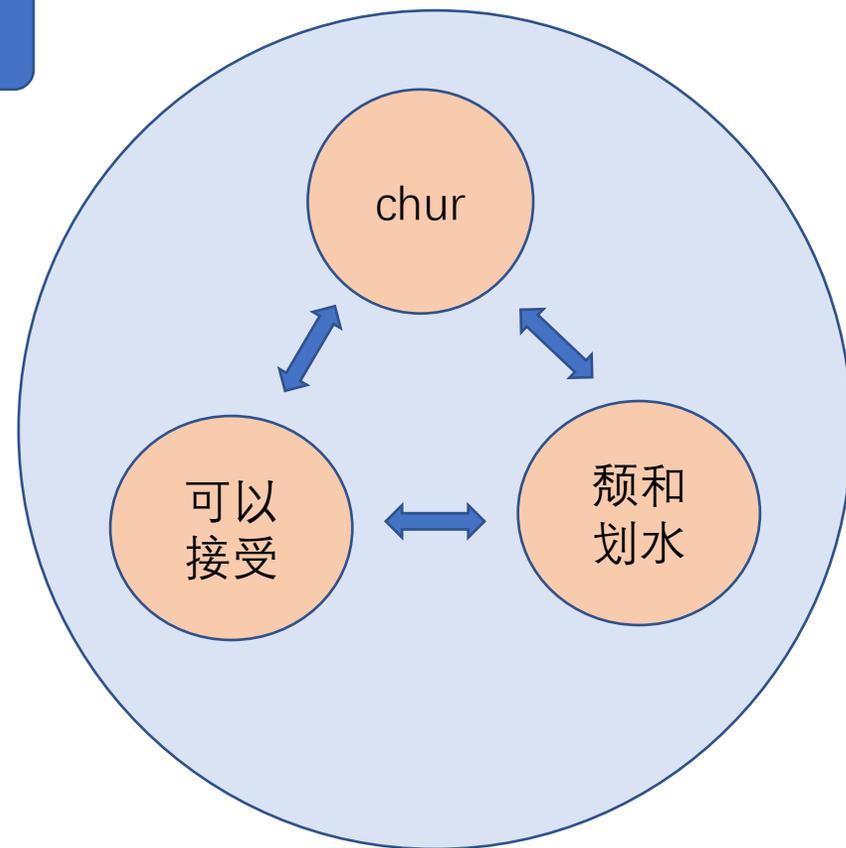
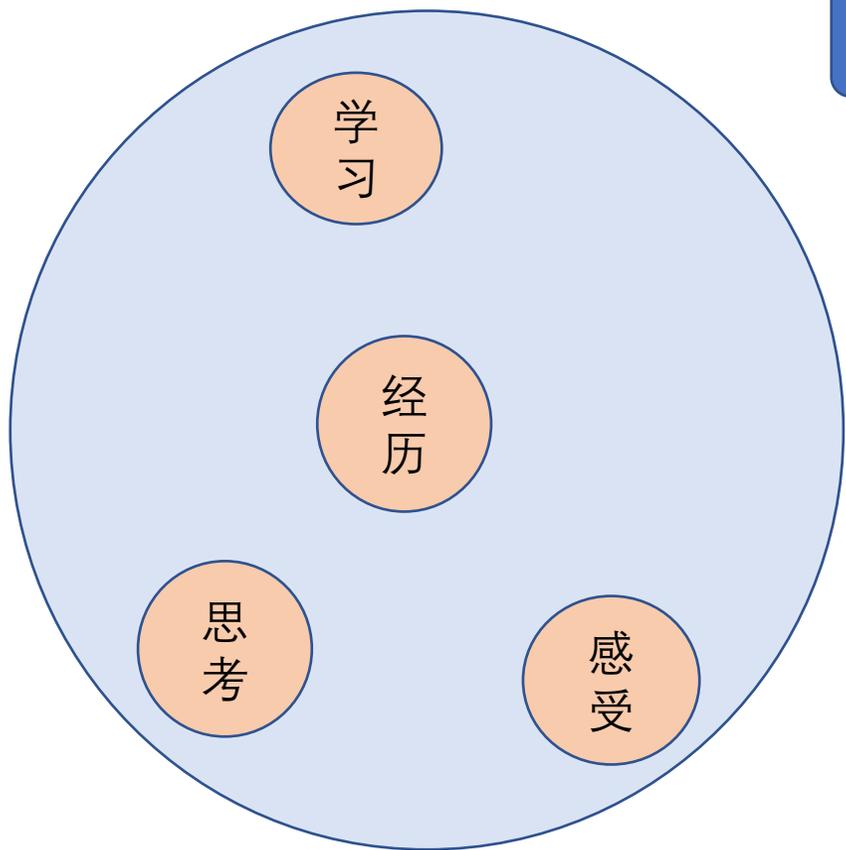
# 在联系教授时需要：

- 介绍自己的基础情况  
姓名、感兴趣的方向
- 表明自己的优势点  
所学课程、掌握技能、技能与所申请项目的配适程度
- 明确个人兴趣  
对申请项目的兴趣和未来的发展方向  
选择暑期研究的目的

# 前期准备B-个人计划

目的

Workload



 0609-0615Report.aux	 0702_中期报告.synctex.gz	 0804-081oReport.tex
 0609-0615Report.log	 0702_中期报告.tex	 0804-0810Report.aux
 0609-0615Report.out	 0706.png	 0804-0810Report.log
 0609-0615Report.pdf	 0706-0713.aux	 0804-0810Report.pdf
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 0609-0615Report.tex	 0706-0713.pdf	 0804-0810Report.tex
 0609-0615Report.toc	 0706-0713.synctex.gz	 0806_1.png
 0617-0622report.aux	 0706-0713.tex	 1119_2004_hw5.tex
 0617-0622report.log	 0713_example.png	 activities - 快捷方式
 0617-0622report.pdf	 0714-0720 Report.pdf	 MyopicChannel.png
 0617-0622report.synctex.gz	 0720-0726.aux	 MyopicModel.png
 0617-0622report.tex	 0720-0726.log	 Report_template.aux
 0623-0629 Report.pdf	 0720-0726.pdf	 Report_template.log
 0630-0705Report.aux	 0720-0726.synctex.gz	 Report_template.pdf
 0630-0705Report.log	 0720-0726.tex	 Report_template.synctex.gz
 0630-0705Report.pdf	 0730-0803Report.aux	 Report_template.tex
 0630-0705Report.synctex.gz	 0730-0803Report.log	 Testing.aux
 0630-0705Report.tex	 0730-0803Report.pdf	 Testing.log
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 0702_中期报告.log	 0730-0803Report.tex	 Testing.synctex.gz
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- Report
- RS\_encode-decode
- stash
- 1.jpg
- 1.png
- 0525\_Group\_testing\_paper\_Johnson.pdf
- 0525\_Network\_Paper.pdf
- 0527\_reimbursement\_guideline.pdf
- 0530\_Project\_Ideas.docx
- 0604\_book\_Elements.of.Information.Theory.pdf
- 0604\_paper list .docx
- 0605\_CS250\_Lecture1-compressed.pdf
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- 0607\_Lecture4-compressed.pdf
- 0607\_Lecture5-compressed.pdf
- 0607\_Lecture6-compressed.pdf
- 0608\_textbook\_Information\_Theory\_Textbook.pdf
- 0610-0614.docx
- 0611\_essential\_coding\_theory.pdf
- 0613\_AVC\_Week\_2.pdf
- 0613\_Sufficiently Myopic Adversaries are Blind.pdf
- 0614\_myopic\_Brief.pdf
- 0617\_Clean-Mask Schrem\_sid.pdf
- 0618\_Generalized List Decoding.pdf
- 0618\_LP Bound.pdf
- 0620\_An\_example\_Geophysics\_report.pdf
- 0621\_LP Bound.pdf
- 0622\_LP Bound\_slides.pdf
- 0622-0629 Report.pdf
- 0624\_yihan\_presen.pdf
- 0624\_yihan\_thesis.pdf
- 0626\_EngineeringWorkshop\_ResearchReportWriting\_June2020\_slides.pdf
- 0626\_ILC workshop\_material.pdf
- 0626\_LP bound.pdf
- 0627\_CS250\_lecture6-Concatenated Code and Zyablov bound.pdf
- 0627\_Lecture7-compressed.pdf
- 0627\_When are large codes possible for AVCs.pdf
- 0629\_Generalized AVCs.pdf
- 0701\_QuadraticallyConstrainedMyopicAdversarialChannels.pdf
- 0702\_Presen.pdf
- 0702\_Sid\_omni\_AVCs\_extended.pdf
- 0702\_Sid\_omni\_AVCs\_extended.pdf~RF1d360133.TI
- 0703\_random linear code.pdf
- 0705\_decode of concatenated code.pdf
- 0711\_decodable GV code.pdf
- 0711\_GLC meet GV.pdf
- 0714\_MyopicSymmetrizabilityExtended.pdf
- 0715\_Presen\_Slides.pptx
- 0725\_Lee Matrix.pdf
- 800px-Hamming(8,4).svg.png
- 0803.docx
- 0806\_Pre.pptx
- 0820\_Pre.pptx
- 0825\_JC\_Part1.pdf
- 0825\_JC\_Part2.pdf
- 0910\_icb文案.docx
- 6130\_week1\_Oct.11\_notes.pdf
- 3113616030865b4fa6c661bfa99fe35.jpg
- CommonRandomness.pdf
- GaussianAVC.pdf
- GMD0723.m
- GV0812.m

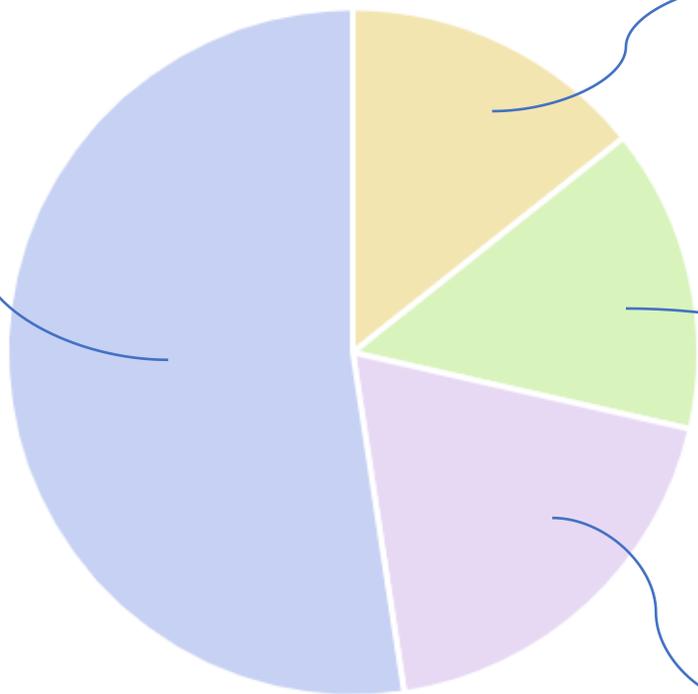
学习基础知识  
了解当前领域进展

确立课题  
学习相关课题paper

Idea和产出的分享  
Presentation

# 日常工作

日常：  
学习所在方向的知识  
研习相关方向的paper。

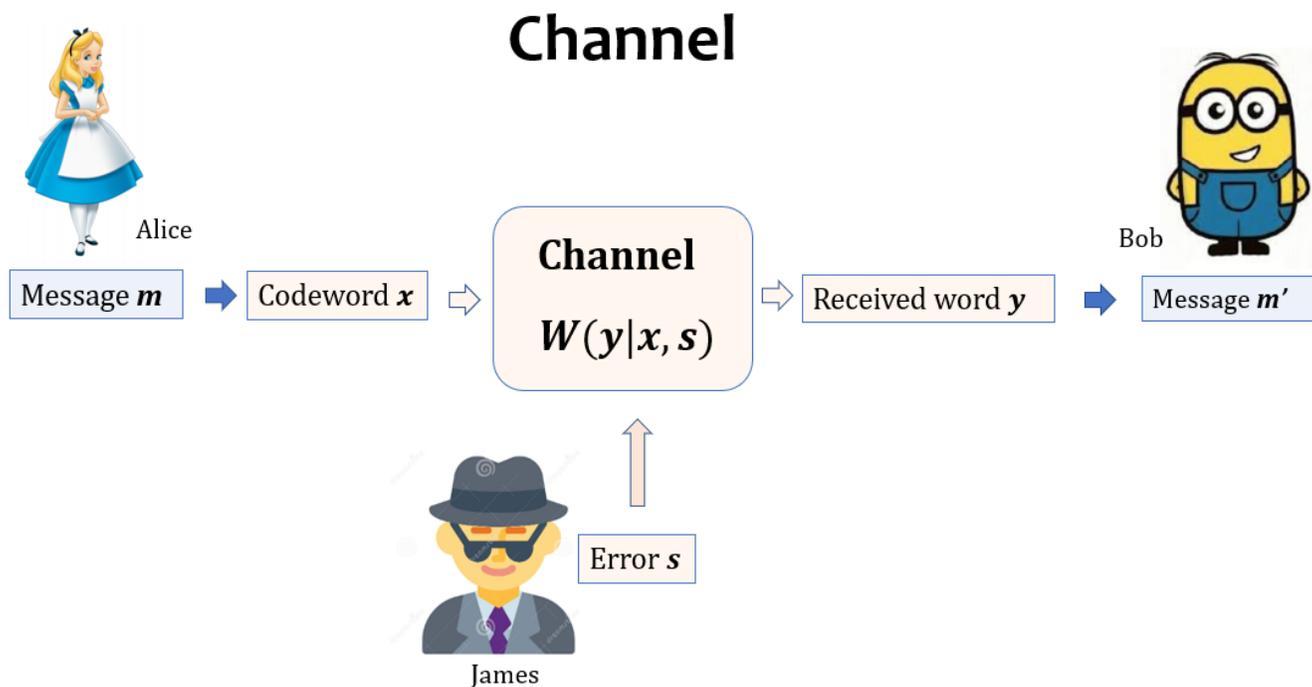


大量的presentation  
和report

思考：调动自己的  
知识储备彼此勾  
连，产出创新点

交流：和同组的成员和  
supervisor交流、沟通，  
探讨想法的可行性

# 研究重点-偏理论的研究



## Topic: 信息论和编码理论

研究不同形式的密码，探索不同 channel 下不同密码搭配的配适程度和所能突破的传递速率。

设计更安全有效的信息传播方式。

# 技能树-IE方向

技能树：熟练掌握概率论、测度论、抽象代数，并需要计算机语言进行辅助和测试（matlab、wxmaxima，某一种计算机语言）。

- 前期要学的东西特别多，需要广泛的了解方向。
- 有很多未解决的问题。
- 前沿的研究相对会比较focus在典型的模型（各种channel, 各种条件限制下的group testing）。

## Repetition codes

Shortly, we just repeat each bit a prearranged number of time, and determine the block by output.

As Bayes' Theorem introduced  $P(A|B) \cdot P(B) = P(B|A) \cdot P(A)$ , in which  $P(A|B)$  denotes the likelihood of event  $A$  occring when  $B$  is true. So then we compare the **posterior probability**(the conditional probability of an event which is assigned after the relevant evidence are given into account):

$$P_1(s = 1|r_1r_2r_3) = \frac{P(r_1r_2r_3|s = 1)P(s = 1)}{P(r_1r_2r_3)}$$
$$P_2(s = 0|r_1r_2r_3) = \frac{P(r_1r_2r_3|s = 0)P(s = 0)}{P(r_1r_2r_3)}$$

## PROJECT IDEAS

Adversarial channels:

- 1.1 Beyond Plotkin (applications to beyond-GV?)
- 1.2 State estimation
- 1.3 CN-symm vs. CP symm, myopic analogues, ...
- 1.4 Quad constrained myopic achievability
- 1.5 Numerical software to calculate

Group-testing:

- 2.1 Correlated tests (COVID applications)
- 2.2 Generalized GT

Network coding:

- 3.1 Spacelink testbed
- 3.2 Delay-sensitive NC -- capacity approximation
- 3.3 Delay-sensitive NC -- low-complexity error-correction



Part2

# 研究工作的真实感受



# 个人收获

- 一整套学术流程的培养
- 越早开始科研，就越早能从科研中获益
- 也许会遇到一个非常喜欢的教授和一群非常厉害的人
  - ✓ 推荐信，和教授和前辈熟悉后的建议和资源
  - ✓ 从教授身上感觉到一个学术大牛的学术素养和习惯
- 祛魅科研：其实没什么大不了
  - ✓ 摆正心态-和教授/supervisor之间的利益关系

# 纠结时刻

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- Y1适合做暑期研究吗?
- 觉得自己好笨没有产出压力好大:  
peer pressure
- 遇到不喜欢/觉得不能做的课题怎么办?

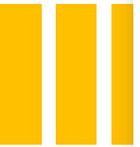
I too had the good fortune to be surrounded by smart(er) people throughout my undergraduate/postgraduate/professorial careers. Learning to appreciate others' qualities, and also one's own qualities, and trying to meld them into a bigger whole, is one of the pleasures of collaboration (research or otherwise). Even if you think of yourself as not as smart as someone else, don't discount the possibility that hard work can substitute for supposed "smartness" -- results are 99% perspiration and 1% inspiration. And in research/exploring the frontiers of human knowledge, one is always stuck -- if one weren't then it would likely already be known/not very interesting.

I'm particularly happy that you appreciate the impulse to pay it forward. That's what humanity is all about, passing the torch on. Keep burning bright, young one!



# Tips

1. 前期要多尝试，遇到没兴趣的大方向赶紧换。
  2. 灵感、想法随时想到随时记下来。
  3. 如果没有新的好想法，就去继续学习、继续看paper。
  4. 多多了解IEEE之类的会议的最新presentation，从中获取目前的前发展状态。
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# Appendix

- Books:

- 1. A classic book on [Information Theory](#).
- More advanced books: [ElGamal-Kim](#) and [Csiszar-Korner](#)
- 2. A nice new book on [coding theory](#) I quite like.
- I'd also recommend the [book by Roth](#).

- 

- Courses:

- 1. [Coding theory](#) by Mary Wootters.
  - 2. Coding theory by [myself](#) (includes videos, see "Course Information" post)
  - 3. [Information Theory](#) by Tsachy Weissman
  - 4. [Information Theory](#) by myself (includes videos, see "Course Information" post)
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